ISO TC 184/SC4 DRAFT STANDING DOCUMENT

Technical Committee 184 for Industrial Automation Systems and Integration
Subcommittee 4 for Industrial Data

Supplementary directives for the drafting and presentation of ISO 10303, edition 2

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Foreword

The ISO (International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body that is interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

This standing document was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

International Standards produced by ISO/TC 184/SC4 are prepared according to guidelines put forth in the following standing documents:

— Guidelines for application interpreted construct development;

— Guidelines for application interpreted model development;

— Guidelines for the development and approval of STEP application protocols;

— Guidelines for the development of abstract test suites;

— Guidelines for the development of mapping tables;

— ISO/TC 184/SC4 organization handbook

— Supplementary directives for the drafting and presentation of ISO 10303.

Annex A forms an integral part of this standing document. Annexes B and C are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, and each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1.

The purpose of this standing document is to provide methods and procedures for the development of parts of ISO 10303. This standing document specifies requirements for the content, layout, and style for all parts of ISO 10303, *Industrial automation systems and integration - Product data representation and exchange*. This standing document augments the 1989 edition of ISO Directives Part 3 and does not supersede it.

This standing document is divided into nine clauses. Clause 1 gives general information on the scope of this standing document. Clause 2 gives a list of normative reference for this standing document. Clause 3 gives lists of definitions and abbreviations that help explain the content of this standing document. Clause 4 gives specific instructions on the elements that comprise the parts of ISO 10303 and requirements for the format to be followed to prepare those elements. Clause 5 gives rules and guidelines for documenting EXPRESS language statements. Clause 6 gives rules and guidelines for documenting the integrated resource series and other parts of ISO 10303 that include definitions of EXPRESS schemas that require TYPE, ENTITY, and FUNCTION definitions. Clause 7 gives rules and guidelines for documenting the application interpreted construct series. Clause 8 gives rules and guidelines for documenting the application protocol series. Clause 9 gives preliminary rules and guidelines for documenting the abstract test suite series. Further rules and guidelines for documenting this last series will be added when those requirements are more stable.

This standing document is partially derived from the 1989 edition of ISO Directives Part 3 - *Drafting and presentation of International Standards* that specifies the general requirements, form, and language for the production of an International Standard. This standing document includes requirements specific to ISO 10303. For these reasons, ISO Directives Part 3 and these Supplementary Directives provide the set of rules for creating an acceptable part of ISO 10303. As with the ISO Directives, this standing document is intended to ensure that all parts of ISO 10303 satisfy the requirement that:

> "Uniformity of structure, of style, and of terminology shall be maintained not only within each Standard, but also within a series of associated standards."

The statement in quotation marks was taken from ISO Directives Part 3.

Supplementary directives for the drafting and presentation of ISO 10303, edition 2

1 Scope

This standing document specifies the elements that make up the parts of ISO 10303, sets out rules for the appearance of those elements, and provides certain appropriate wording to be used to prepare those elements.
The following are within the scope of this standing document:

— preliminary elements: those elements that identify the standard, introduce its content, and explain the background, its development, and its relationship with other standards;

— normative elements: those elements setting out the provisions with which it is necessary to meet claim conformity with this International Standard;

— supplementary elements: those elements that provide additional information intended to assist in the understanding or use of this International Standard;

NOTE 1 - Supplementary elements provide information that is informative but not an integral (normative) part of an International Standard

— directions for the format to be followed to create the elements that "together forms a standard."

NOTE 2 - The wording in quotation marks was taken from ISO Directives Part 3.

The following is outside the scope of this standing document:

— the technical content of parts of ISO 10303.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provision of this standing document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standing document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of the IEC and ISO maintain registers of currently valid International Standards.

ISO 690:1965, *Documentation - Bibliographic references - Content, form, and structure*.

ISO 10303-1:1994, *Industrial automation systems and integration Product data representation and exchange Part 1: Overview and fundamental principles*.

ISO 10303-202:1996, *Industrial automation systems and integration - Product data representation and exchange - Part 202: Associative draughting*.

The following documents contain provisions which, through reference in this text, constitute provisions of this Standing Document. At the time of adoption, the revisions of the documents indicated were valid. All documents are subject to revision, and users of this Standing Document are encouraged to investigate the possibility of applying the most recent revisions of the documents indicated below.

ISO TC 184/SC4, *Guidelines for application interpreted construct development*, N434, 1997

ISO TC 184/SC4, *Guidelines for application interpreted model development*, N532, 1998

ISO TC 184/SC4,*Guidelines for the development and approval of STEP application protocols*, N535, 1997

ISO TC 184/SC4, *Guidelines for the development of abstract test suites*, N536, 1997

ISO TC 184/SC4, *Guidelines for the development of mapping tables*, N533, 1997

IEC/ISO Directives, Part 3, *Drafting and presentation of International Standards, Third edition*, 1997

The Concise Oxford Dictionary of Current English, ninth edition, 1995.

3 Terms, definitions, and abbreviations

3.1 Terms defined in ISO 10303-1

For the purpose of this standing document, the following terms defined in ISO 10303-1 apply.

3.1.1
application activity model (AAM)
a model that describes an application in terms of its processes and information flows.

> NOTE - The entire definition of a term defined in another part of ISO 10303 is not usually repeated in another document. However, since the intent of the standing documents is to assist members of TC 184/SC4 in developing standards, definitions necessary to understand each standing document are repeated in that standing document.

3.1.2
application object
an atomic element of an application reference model that defines a unique concept of the application and contains attributes specifying the data elements of the object.

3.1.3
application protocol (AP)
a part of this International Standard that specifies an application interpreted model satisfying the scope and information requirements for a specific application.

NOTE - This definition differs from the definition used in open system interconnection (OSI) standards. However, since this International Standard is not intended to be used directly with OSI communications, no confusion should arise.

3.1.4
application reference model (ARM)
an information model that describes the information requirements and constraints of a specific application context.

3.1.5
conformance class
a subset of an application protocol for which conformance may be claimed.

3.1.6
implementation method
part of this International Standard that specifies a technique used by computer systems to exchange product data that is described using the EXPRESS language.

3.1.7
interpretation
the process of adapting a resource construct from the integrated resources to satisfy a requirement of an application protocol. This may involve the addition of restrictions on attributes, the addition of constraints, or the addition of relationships among resource constructs.

3.1.8
product data
a representation of information about a product in a formal manner suitable for communication, interpretation, or processing by human beings or by computers.

3.1.9
resource construct
a collection of EXPRESS ENTITIES, TYPES, FUNCTIONS, RULES, and REFERENCES that together define a valid description of an aspect of product data.

3.1.10
unit of functionality (UoF)
a collection of application objects and their relationships that defines one or more concepts with the application context such that removal of any component would render the concepts incomplete or ambiguous.

3.2 Terms defined in ISO 10303-202

For the purpose of this standing document, the following terms defined in ISO 10303-202 apply.

3.2.1
application interpreted construct (AIC)
a logical grouping of interpreted constructs that supports a specific function for the usage of product data across multiple application contexts.

3.3 Abbreviations

For the purposes of this standing document, the following abbreviations apply.

AAM	application activity model
AIC	application interpreted construct
AIM	application interpreted model
AP	application protocol
ARM	application reference model
ATS	abstract test suite
CD	committee draft
DIS	Draft International Standard
(E)	English
FDIS	Final Draft International Standard
IR	integrated resource
IS	International Standard
ISO	International Organization for Standardization
SC4	Subcommittee 4
TC 184	Technical Committee 184
UoF	unit of functionality
WD	working draft

4 Requirements for the content, layout, and style of parts of ISO 10303

A list of elements that comprise the content of parts of ISO 10303 is shown in Table 1.

Table 1 - Arrangement of elements

Type of Element		Element
Preliminary		Title Page* Contents,* Figures, Tables Foreword* Introduction*
Normative	General	Title* Scope* Normative references*
	Technical	Definitions* Symbols and abbreviations One or more clauses giving requirements* Normative annexes*
Supplementary		Informative annexes Footnotes Index*
*These elements are required for parts of ISO 10303		

In many of the elements, specific wording is required. To clearly identify required ISO 10303 test from the rest of the text in this document a convention has been established. All required text shall begin with " [ISO 10303 required]" and shall end with "[end required]". (The reader will be reminded of this at various locations throughout this standing document.) Information requested within angle brackets (< >) is to be provided by the part editor. If specific wording is to appear in boldface, the reader will be given instructions to that effect.

By special agreement, the text of the parts of ISO 10303 shall be prepared only in the English language. Translations to other languages will be made only after the part has achieved Draft International Standard (DIS) status.

4.1 Instructions for the page layout for parts of ISO 10303

This subclause gives rules and guidelines specific to the layout for all parts of ISO 10303.

4.1.1 Margin settings

All parts of ISO 10303 at the Draft International Standard, Final Draft International Standard, or International Standard level shall be prepared to be printed on A4 (metric standard) paper stock. Documents at the Committee Draft level or below may be prepared to be printed on either A4 or A (U.S.) paper stock. Margins should be set so that text is centred horizontally and vertically on the page. When

printed on A4 paper, margins shall be 2.54 cm (one inch) on the left and right sides of the page and at least 2.54 cm (one inch) at the top and bottom of the page. Except for pages that are printed in landscape, margin settings shall be consistent throughout the document. If it is necessary to accommodate a table in landscape style, the left and right margins may be reduced but the top and bottom margins shall not be. Page headers, footnotes, and page numbers shall not extend into the margins.

NOTE 1 - Editors who print their documents that are at the CD level or below on A (U.S) paper stock may want to set their margins to accommodate the required change to the A4 (metric standard) paper stock at the DIS level.

NOTE 2 - Once in landscape style, left and right margins become what were formerly top and bottom margins.

NOTE 3 - The requirement to centre the text does not refer to line justification, merely the placement of text on the printed page.

4.1.2 Acceptable word processors

Editors may use WordPerfect 6.1, Word 7.0, or SGML to prepare their documents. Those already using WordPerfect 5.1 may complete their work but editors just beginning documents shall not use it. The long-term goal is the use of SGML to prepare all documents.

Documents may be submitted to the ISO secretariat in a digital format using the Portable Document Format (PDF).

4.1.3 Acceptable fonts

Acceptable fonts for use in the preparation of parts of ISO 10303 are:

— 17 point Times Roman or Computer Modern for the title that appears at the top of the first page of the main body of the text;

— 14 point Times Roman or Computer Modern for the headings for the Foreword, Introduction, Contents, clauses, subclauses except definitions, annexes and the index; and titles for tables and figures;

— 11 point Times Roman or Computer Modern for the general text, words that are defined and the numbers that precede each one, the list headings "Figures", and "Titles" that appear in the Contents, the word "Page" that appears above the list of page numbers in the Contents, and page headings;

NOTE - "Words that are defined" are the words for which you give meanings (definitions) in your part of ISO 10303.

— 10 point Times Roman or Computer Modern for notes, examples, and the copyright statement, using the same font chosen for headings and text;

— 10 point monospace (Courier or LaTeX typewriter) for EXPRESS language statements including those in notes and examples;

— 10 point monospace (Courier or LaTeX typewriter) for Internet URL addresses;

— 8 to 11 point size of any of the above and other monospace fonts for figure text and boxes;

— 8 and 10 point Times Roman or Computer Modern for EXPRESS-G diagrams' entity names and attribute names/labels, respectively, in the same font chosen for general text;

— 8 point Times Roman or Computer Modern for footnotes in the same font chosen for general text.

If these fonts are not available, a typeface from a Times family should be used.

The same typeface shall be used for headings, notes, examples, and general text.

Unacceptable fonts for use in the preparation of parts of ISO 10303 are anything below 8 point.

4.1.4 Page headings

Except for the page on which the Scope clause begins, a page heading (usually referred to as a "header" or "running head") shall appear in boldface on every page of every document in the same font as the general text. The header for the parts of ISO 10303 that have not reached the IS (International Standard) stage shall be ISO/<specify status of document>, one blank space, 10303-<specify part number>:<year of publication>(E).

To specify the status of the document, choose one of the following:

— "WD" to indicate working draft;

— "CD" to indicate committee draft;

— "DIS" to indicate Draft International Standard;

— "FDIS" to indicate Final Draft International Standard.

All page headings shall be followed by a single blank line.

When placed on an odd-numbered page, this information shall be recto (on the right). When placed on an even-numbered page, this information shall be verso (on the left). The page heading shall be left-justified on pages that are verso and right-justified on pages that are recto.

For parts that have reached the DIS (Draft International Standard) and FDIS (Final Draft International Standard) stages, the copyright symbol and the letters "ISO" shall appear on the opposite side of the page on the same line as the information described in the previous paragraphs. The copyright symbol and ISO shall not be in boldface.

For parts that have reached the IS (International Standard) stage the header shall be ISO 10303-<specify the part number>:<specify year of publication>(E). This information shall be in boldface. The copyright symbol followed by the letters "ISO" shall appear on the same line on the opposite side of the page. The copyright symbol and ISO shall not be in boldface.

EXAMPLE 1 - The header for a part of ISO 10303 that is at the CD stage is **ISO/CD 10303-<part number>:<year of publication>(E)** with no copyright symbol or the letters "ISO" on the opposite side of the page. For a document at the WD stage, replace "**CD**" with "**WD**".

EXAMPLE 2 - The header for part of ISO 10303 that is at the DIS stage is **ISO/DIS 10303-213:1996(E)**. As explained above, the copyright symbol (©) followed by the letters "ISO" should appear on the same line on the opposite side of the page. For a document at the FDIS stage, replace the letters "DIS" with "FDIS."

EXAMPLE 3 - The header for a part of ISO 10303 that is an approved International Standard is the copyright symbol followed by the letters "ISO" on one side of the page and **ISO 10303-<part number>:<year of publication>(E)** on the same line on the opposite side of the page.

For the page on which the Scope clause begins, suppress the general header (as described above) and use the following header:

[ISO 10303 required]

INTERNATIONAL STANDARD ©ISO ISO 10303-<specify part number>:<specify year>(E)

[end required]

Where a part has not reached DIS, FDIS, or IS status, omit the copyright symbol and use the letters ISO in parentheses, i.e., "(ISO)". On the opposite side of the page, follow ISO with "/<specify status of document> a space followed by 10303-<specify the part number>". This page header shall be 11 point and shall not be in boldface.

4.1.5 Clauses and subclauses

The main body of text of an International Standard is documented in a series of clauses and subclauses. A clause is the basic component of the subdivision of text of an International Standard. A subclause is a numbered subdivision of a clause while a subsubclause is a numbered subdivision of a subclause.

All clauses, subclauses, and subdivisions of subclauses shall begin flush left without indentation. All text shall be single spaced and shall be prepared using full justification. Words shall have a single space between them. Some word processors may cause the appearance of a additional space to provide full justification. Excess space between words for the sake of right justification shall be avoided. Words may be hyphenated to avoid this. No line of text shall extend into any margin.

In general, beginning with the first page of the Scope clause, clauses throughout the main body of the text shall follow each other without page breaks. Because parts of ISO 10303 often contain a large number of pages making them difficult to edit when this rule is followed, ISO Central Secretariat has relaxed the rule for TC 184/SC4. However, the start of a new clause is the only place where text may begin on a new page. The two methods of breaking pages may be combined in the same document. Short clauses should follow each other without page breaks.

There shall be two blank lines, at 11 point spacing, before the beginning of a new clause. There shall be one blank line, at 11 point line spacing, before the beginning of a new subclause.

Each annex and the Index shall begin on a new page.

4.1.5.1 Clause and subclause headings

A clause or subclause heading is the wording used to introduce a clause or subclause.

> NOTE 1 - The use of headings to introduce subclauses below the third level (i.e., subclauses below the X.X.X level) is a deviation from ISO Directives Part 3. However, because of the complexity of the material being documented in ISO 10303, TC 184/SC4 approved the use of such subclause headings.

Clause and subclause headings shall begin flush left and be in boldface in 14 point type on a line by themselves. Beginning with the Scope clause, all headings shall be numbered with Arabic numbers in sequence. The number for clause headings shall be followed by two spaces and the text of the headings.

There shall be no period following the clause or subclause number. The first word in all headings shall be capitalized. All other words in the heading shall be lower case unless they are proper nouns.

> EXAMPLE - **4.1 Units of functionality**

This requirement may be superseded by specific requirements for EXPRESS entity names that are documented in clauses 6 and 7 of this standing document.

> NOTE 2 - As in the above example, an exception to the rule that examples shall appear in 10 point type has been made in various places throughout this standing document so that editors can see exactly how the information being presented should appear. This exception has also been made for some models.

If a heading "wraps around" to a second line, that second line shall begin flush left directly beneath the first character of the line above (under the clause number). Long titles that wrap around should be avoided, if possible.

Clause headings shall be preceded and followed by two 11 point blank lines. Subclause headings shall be preceded and followed by one 11 point blank line. No clause or subclause heading shall appear by itself at the bottom of a page. A heading that would normally do this should be forced to the top of the next page with the use of a required page break.

Legal style shall be used for numbering of subclauses. Legal style is as follows:

> — Subdivisions of a clause or subclause shall be sequentially numbered with Arabic numbers beginning with 1;
>
> — This number shall be preceded by the number of the clause or subclause of which it is a subdivision;
>
> — The number of the subdivision shall be separated from the number of the clause or subclause of which it is a subdivision by a full stop (".");

— The number of a subdivision shall not be followed by a full stop.

NOTE - The clause and subclause numbering in this standing document follow the legal style of numbering.

4.1.5.2 Paragraphs

Paragraphs are subdivisions of clauses or subclauses. Paragraphs shall be unnumbered and untitled. All text shall be single spaced without indentation. There shall be one blank line between paragraphs.

4.1.5.3 Orphans and widows

When a page break occurs in mid-paragraph, care shall be taken not to have the first or last line of a paragraph appear on a page by itself. Printing the first line of a new paragraph as the last line on a page is referred to as "creating an orphan". Printing the last line of a paragraph as the first line of a new page is referred to as a "creating a widow". Orphans and widows shall not appear in general text or EXPRESS statements.

In addition, clause and subclause headings, the words "EXAMPLE" and "NOTE", titles for tables and figures, and EXPRESS delimiters shall not appear at the bottom of a page without at least two lines of the text following them.

NOTE - The requirement to avoid orphan and widow lines should be addressed immediately prior to release for ballot.

4.1.6 Page numbering

Pages shall be numbered at the bottom of the page beginning with the page on which the Contents appears.

Page numbers of odd-numbered pages (recto) shall appear flush right at the bottom of the page. Page numbers for even-numbered pages (verso) shall appear flush left at the bottom of the page. Page numbers of the lists of contents, figures, and tables and the Foreword and Introduction shall be in lower case Roman numerals beginning with "ii".

Page numbers beginning with the page on which the Scope clause begins shall be in Arabic numbers beginning with "1".

Page numbers for pages within annexes shall not be prefixed with the letter identifier of the annex.

4.1.6.1 Use of blank pages

To allow the Scope clause to begin on a right hand (odd-numbered) page, a blank page may be inserted after the last page of the Introduction if that page is odd numbered. This blank page shall be numbered with the appropriate lower case even-numbered Roman numeral, e.g., "vi", "viii", or "x", and shall contain the same header as the other pages in the document. This page shall not include any other text, i.e., "This page left blank". or "Blank page". This is the only place where a blank page can be inserted in a part of ISO 10303.

4.1.7 Format for lists in parts of ISO 10303

A list shall be introduced using one of the following forms:

— a complete prepositional phrase followed by a colon;

— a preposition without a colon.

Both of these are followed by the actual list.

EXAMPLE 1 - Examples are not required for any of the following:

EXAMPLE 2 - This can be explained by

Each item in a list shall be preceded by a long dash (em dash) followed by a blank space (see Example 1).

EXAMPLE 1 - The following is an example of text with a one-level list.

Text xxxxx:

— xxxxx;

— xxxxx;

— xxxxx.

If further subdivision of the text is required, then sublist may be used. If this happens then each item in a list shall be preceded by a lower case letter followed by a right parenthesis followed by a blank space (see Example 2).

Each item in the sublist shall be preceded by a Arabic number letter followed by a right parenthesis followed by a blank space. If even further subdivision of the text is required, each item in the subsublist shall be preceded by an lower case roman numeral followed by a right parenthesis followed by a blank space (see Example 3). Lists should be uniformly indented from the left margin the equivalent of three or five spaces in monospaced fonts.

EXAMPLE 2 - The following is an example of text with a two-levels list.

Text xxxxx:

a) xxxxxx

1) xxxxx;

2) xxxxx.

b) xxxxxx

1) xxxxx;

2) xxxxx.

EXAMPLE 3 - The following is an example of text with a three-level list.

Text xxxxx:

a) xxxxxx

1) xxxxx

i) xxxxxx;

ii) xxxxxx.

2) xxxxxx

i) xxxxx;

ii) xxxxx.

b) xxxxxx

1) xxxxxx

i) xxxxxx;

ii) xxxxxx.

2) xxxxxx

i) xxxxx;

ii) xxxxx.

In most cases, the first word of each entry in a list should begin with a lower case letter. Exceptions to this rule are if each entry is a complete sentence or begins with a proper noun, the first letter of the first word should be capitalized. If the text of an item being listed wraps to the next line, the second line of the text shall be indented three or five spaces, i.e., continued under the long dash (em dash), lower case letter, or Arabic number (depending on the level of this list). There may be exceptions to this rule. Editors will be alerted to those exceptions.

Each entry shall be followed by a semicolon (preferred) or a full stop (period) except for the final item which shall always be followed by a full stop. Each item in a list shall be followed by a blank line.

NOTE - The lists in this standing document follow this format.

4.2 Preliminary elements

Preliminary elements are those elements that introduce a standard. A list of preliminary elements for parts of ISO 10303 is given in Table 1 of this standing document.

4.2.1 Title page

The ISO Central Secretariat will prepare the final title page. To prepare a placeholder for that title page, complete the title page presented in annex A of this standing document. This title page summarizes the status of the parts of ISO 10303 in the standardization process, serves as a cover for parts of ISO 10303 until ISO prepares the official version, and shall be attached to all documents distributed for comment. Instructions for completing the title page and along with an electronic version of the title page are located at the following URL:

<http://www.nist.gov/editing/cover/>

4.2.2 Contents

All parts of ISO 10303 shall contain a Contents that shall begin with an entry for the Scope clause and include the complete title of all clauses and higher-level subclauses included in the main body of the document and the page number on which each begins. For clause 3 “Terms, definitions and abbreviations”, do not include terms in the Contents. This shall be followed by a list of annexes, an entry for the Bibliography, an entry for the Index, a list of figures (if included), and a list of tables (if included).

The list of annexes shall include the complete title of all clauses and subclauses in each annex and the number of the page on which each begins (see 4.3.2.4.4). The index entries in the Contents shall have the following form: “Annex <letter> (<normative or informative>) <Annex title> ...”

Note - This is a change to the ISO/IEC Directives Part 3:1997. Do not use older standards as examples.

This shall be followed by a single entry "Bibliography" and include the page number on which the Bibliography begins. This shall be followed by a single entry "Index" and include the page number on which the Index begins. The next list shall be titled "Figures" and shall include the number, complete title, and page number of all figures. The final list shall be titled "Tables" and shall include the number, complete title, and page number of all tables. If there are no figures or tables, do not include the related heading.

The titles "Contents", "Figures", and "Tables" shall begin flush left with a single blank line between the title and the list. There shall be two blank lines preceding the titles "Figures", and "Tables". The word "Page" shall appear above the column of page numbers on the first page of the Contents. It shall appear on the same line as the title "Contents" and shall be flush right. There shall be dot leaders between the end of the listed items and the page numbers. The "Contents" shall begin on left-hand page (verso) "ii". The list of annexes, figures and tables shall follow the Contents without a page break. The title "Contents" shall appear in boldface in 14 point type. "Figures", and "Tables" shall appear in boldface in 11 point type. The entries in all lists and the word "Page" shall be in 11 point type and shall not appear in boldface.

The headings of the major subclauses in the Contents and annexes shall be indented from the left margin two spaces. Subclauses of major subclauses shall be indented two spaces more than the major subclauses. Except for application protocols, the Contents shall contain entries to the third level (to the subsubclause level) of the document. (See 8.1 for documentation on the Contents for APs.) Terms being defined in the Terms and definitions clause and their subclause numbers shall not be listed in the Contents.

NOTE - This standing document's Contents follows this format.

The following copyright information shall appear as shown below in 10 point type at the bottom of the first page of the Contents for all parts of ISO 10303 that have reached the DIS, FDIS, or IS stage:

[ISO 10303 required]

International Organization for Standardization
Case Postale 56 - CH-2111 Geneve 20 - Switzerland
<For IS parts, leave one blank line and add the following beginning at the margin.>

Printed in Switzerland
[end required]

4.2.3 Foreword

While a Foreword is required for all documents, parts of it are optional. The following instructions outline which paragraphs are required and which are optional. Each description is followed by the wording to be used to compose that part of the Foreword. Any information not covered by the text described here does not belong in the Foreword. To ensure that information important to an introduction is included, place it in the Introduction.

4.2.3.1 Placement of the foreword

The Foreword shall begin on a new page immediately following the lists of contents, figures, and tables. The pages of the Foreword shall be numbered with Roman numerals following the sequence already established. There shall be one blank line between the title "Foreword" and the first line of the text.

4.2.3.2 Wording for the foreword

The following wording has been supplied by ISO Central Secretariat and is required in all parts of ISO 10303.

[ISO 10303 required]
"ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical

committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

"Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote."

International Standard ISO 10303-<specify part number> was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

ISO 10303 consists of the following parts under the general title *Industrial automation systems and integration - Product data representation and exchange*:
[end required]

If the standard is a second edition, do not include any additional detail about the changes from the first edition. These should be included in the Introduction. Change the third introductory paragraph to the following:

[ISO 10303 required]
International Standard ISO 10303-<specify part number> was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*. This second edition of ISO 10303-<specify part number> cancels and replaces the first edition (ISO 10303-<specify part number>:<year of publication>), of which it constitutes a technical revision.
[end required]

If the standard is a second edition, and has one or more technical corrigenda, add to the third paragraph the following:

[ISO 10303 required]
It incorporates the corrections published in ISO 10303-<specify part number>:<year of publication>/Cor.1:— [1)]
[end required]

If the one or more technical corrigenda have been defined, but not yet published, replace the year number by a long dash ("em dash", —) and add a footnote indicating that it is to be published.

The next paragraph to be included in the Foreword for all ISO 10303 parts is the explanation of the structure of STEP and a reference to the list of all parts, using the URL form mandated by ISO 690-2.

> This replaces the paragraph "ISO 10303 consists of the following parts ...", the list of parts, and the paragraph "Should further parts of ISO 10303 be published ..."

[ISO 10303 required]
This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1.

A complete list of parts of ISO 10303 is available from the Internet:

<http://www.nist.gov/sc4/editing/step/titles/>

[end required]

The following wording is also required and is part of the "titles" file. It will be kept current by the SC4 Secretariat.

[ISO 10303 required]
The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

— Parts 11 and 12 specify the description methods,

— Parts 21 to 26 specify the implementation methods,

— Parts 31 to 35 specify the conformance testing methodology and framework,

— Parts 41 to 49 specify the integrated generic resources,

— Parts 101 to 106 specify the integrated application resources,

— Parts 202 to 232 specify the application protocols,

— . . .

Should further parts of ISO 10303 be published, they will follow the same numbering pattern.
[end required]

The italics in the introductory paragraphs are required.

Complete the Foreword with the following required statements covering annexes. Use the appropriate choice from the following wording, expanding the number of annexes as required:

[ISO 10303 required]

Annex A forms an integral part of this part of ISO 10303. Annex B is for information only.

Annex A forms an integral part of this part of ISO 10303. Annexes B, C, and D are for information only.

Annexes A, B, and C form an integral part of this part of ISO 10303. Annex D is for information only.

Annexes A, B and C form an integral part of this part of ISO 10303. Annexes D, E, and F are for information only.
[end required]

Where there are no annexes of either type, do not include the corresponding sentence.

See 4.3.1.3 and 4.4.1 for explanations of annexes. Annexes that are an integral part of an International Standard (normative) are to be placed before annexes that are for information only (informative) (see Table 1).

> Note - SC4 has been granted an exception to the requirements of the ISO/IEC Directives Part 3: annexes are listed in the order specified by the Supplementary Directives, not in the order in which they appear.

4.2.4 Introduction

An Introduction is required. The Introduction should say what the subject is (definition), why the subject is important (usefulness), and what to look for (key points) in the subsequent sections. The Introduction shall not contain requirements but may contain figures. If it is necessary to include material in the Introduction describing the scope, care shall be taken that the Introduction use the same description as the Scope clause.

4.2.4.1 Placement of the introduction

The Introduction shall begin on a new page immediately following the Foreword. The pages of the Introduction shall be numbered with Roman numerals following the sequence already established. There shall be one blank line between the title "Introduction" and the first line of the text. If the Introduction ends on an odd-numbered page, a blank page shall be inserted before the page on which the Scope clause begins (see 4.1.6.1 for further details).

4.2.4.2 Wording for the introduction

The following wording has been prepared for the introductions to the different series of parts and is based on text from ISO 10303-1.

4.2.4.2.1 integrated resource series

For the parts of ISO 10303 that are members of the integrated resource series, use the following:

[ISO 10303 required]
ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.
[end required]

For the parts with more than one schema, use the following:

[ISO 10303 required]
This part of ISO 10303 is a member of the integrated resource series. Major subdivisions of this part of ISO 10303 are: <use list format to list the names of the schemas, or descriptions of groups of schemas>.
[end required]

For the parts with only one schema, use the following:

[ISO 10303 required]
This part of ISO 10303 is a member of the integrated resource series. This part of ISO 10303 specifies the <schema name>.
[end required]

This may be followed by one or more paragraphs that provide an overview of the schema or schemas, without stating requirements. If information from the Scope clause is repeated, use the same wording as in the Scope.

In an integrated resources part, include a schema level model that illustrates the schema(s) specified in the context of the IRs as a whole, introduced by the following wording:

[ISO 10303 required]
The relationships of the schemas in this part of ISO 10303 to other schemas that define the integrated resources of this International Standard are illustrated in Figure <figure number> using the EXPRESS-G notation. EXPRESS-G is defined in annex D of ISO 10303-11. The <list schemas from other parts depicted in the diagram> are specified in <list the parts>. The schemas illustrated in Figure <figure number> are components of the integrated resources.
[end required]

4.2.4.2.2 application interpreted construct series

For the application interpreted construct series, use the following:

[ISO 10303 required]
ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 is a member of the application interpreted construct series. An application interpreted construct (AIC) provides a logical grouping of interpreted constructs that supports a specific functionality for the usage of product data across multiple application contexts. An interpreted construct is a common interpretation of the integrated resources that supports shared information requirements among application protocols.

This document specifies the application interpreted construct for <AIC functionality>. Additional sentences may be included as necessary to describe the functionality.

> EXAMPLE - This document specifies the application interpreted construct for the description of a geometric shape by means of manifold surface.

[end required]

4.2.4.2.3 protocol series

For the application protocol series, use the following:

[ISO 10303 required]
ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 is a member of the application protocol series. This part of ISO 10303 specifies an application protocol (AP) for <free text description of part in new paragraph>.

This application protocol defines the context, scope, and information requirements for <AP purposes> and specifies the integrated resources necessary to satisfy these requirements.

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarizes the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers to words defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in annex F. The information requirements of the application are specified in clause 4 using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model, is given in annex G.

Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in Annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex C.
[end required]

4.2.4.2.4 abstract test suite series

For the abstract test suite series, use the following:

(To be provided.)

4.2.4.2.5 other parts

For other parts (excluding ISO 10303-1), use the following:

[ISO 10303 required]
ISO 10303 is an International Standard for the computer-interpretable representation of product

information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 is a member of the _____ series. This part of ISO 10303 specifies . . . <free text description of part in new paragraph>."
[end required]

4.2.4.2.6 second edition parts

For second editions, provide a list of the significant technical changes from the previous edition. For the second editions, which are intended to be upwardly compatible with the "initial release" editions, preface this list by the following text:

[ISO 10303 required]
This edition incorporates modifications that are upwardly compatible with the previous edition. Modifications to EXPRESS specifications are upwardly compatible if:

— instances encoded according to ISO 10303-21, and that conform to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;

— interfaces that conform to ISO 10303-22 and to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;

— the mapping tables of ISO 10303 application protocols based on the previous edition of this part remain valid in a revision of that application protocol based on this edition.

[end required]

4.3 Normative elements

Normative elements are divided into two types: general and technical. All general normative elements are required. Some technical normative elements are not required.

4.3.1 General Normative Elements

4.3.1.1 Title

This element is a two-part element. The introductory part of the element indicates the general field in which the International Standard belongs and the main part of the element indicates the specific subject being addressed within that general field. For parts of ISO 10303, the title shall be

[ISO 10303 required]
Industrial automation systems and integration - Product data representation and exchange -
Part ___<specify the number>: _____ <specify the title>.
[end required]

All titles, including the titles of the parts of ISO 10303 shall have a capital letter on the first word of each section. All other words in the section shall be lower case. For the most part, sections of the title should be kept together. However, if they are short, sections may be combined as has been done in the example that follows. If word wrapping is necessary, sections of the title should be broken at the end of a section as has been done in the example that follows. "Part <specify the part number>:" shall always appear on a line by itself.

Example - Industrial automation systems and integration —
Product data representation and exchange —
Part 11:
Description methods: The EXPRESS language reference manual

The title shall appear at the top of the first page of the main body of text. (This is the page on which the Scope clause begins.) The title shall begin flush left and be in boldface. All sections of the title shall be in 17 point type. The punctuation at the end of the first two sections is a long dash. There shall be one blank space after the colon that follows the series designator. The page number for this page shall be Arabic 1. There shall be two blank lines separating the title from the Scope clause that follows, based on 11 point text, not 17 point.

4.3.1.2 Scope

The Scope clause is intended to communicate the area of applicability of the standard. The Scope clause shall include statements of fact that define the subject of the standard, the aspects covered, and optionally, those that are not. The scope may be defined using list format (preferred) or narrative text. If there is only one item within scope, list format shall not be used. If using the list format, all in-scope items shall be given followed by all out-of-scope items.

The Scope clause shall start with the following wording:

[ISO 10303 required]
This part of ISO 10303 specifies ....
[end required]

In most cases this should continue as follows, using a list format to give a sequence of subject areas:

[ISO 10303 required]
This part of ISO 10303 specifies the following:
[end required]

Use the following wording to introduce any further information that is within the scope of the part but does not fit into the first list.

[ISO 10303 required]
The following is (are) within the scope of this part of ISO 10303:
[end required]

Use the following wording to introduce information that is outside the scope of the part.

[ISO 10303 required]
The following is (are) outside the scope of this part of ISO 10303:
[end required]

The scope shall not contain requirements.

NOTE - A typical size for the Scope clause is one page or less.

The Scope clause shall begin following the title and requires a special page heading (see 4.1.4). Its clause number shall be "1".

4.3.1.3 Normative references

This element specifies the normative documents, their titles, and publication dates that are referenced in the text in such a way as to make any part of the referenced document required for the application of the referencing standard. Use the following wording to introduce the normative references:

[ISO 10303 required]
"The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards."
[end required]

Where only one normative reference is being given, the following shall be used:

[ISO 10303 required]
"The following normative document contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. For a dated reference, subsequent amendments to, or revisions of, this publication does not apply. However, parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For an undated reference, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards."
[end required]

Where publications other than standards are being cited as normative references, replace the word "standard" or "standards" with "publication" or "publications" and eliminate the last sentence. If both standards and other publications are being cited as normative references, list them in two separate paragraphs following the instructions for required wording given above. Standards should be mentioned before other publications.

This wording shall be followed by the normative references presented in a special format. The standard reference number shall appear in Roman typeface followed by a colon, the date of publication, and the

title of the normative reference in italic. Each normative reference shall finish with a full stop. Normative references shall be separated from each other by a blank line. Normative references are not indented from the usual left margin.

When referencing other standards, only full ISs, FDISs, or DISs shall be listed and WDs and CDs shall not appear. CD or WD documents may include normative references to standards at any stage of publication. For DISs or FDISs, instead of giving the year of publication, insert a footnote marker and a footnote stating "To be published." A single footnote shall be used for all DIS and FDIS parts.

The following shall not be used as normative references:

— documents that are not publicly available;

— documents to which only informative reference is made;

— documents that have merely served as references in the preparation of the standard.

These documents should be listed in the Bibliography, which is informative.

All parts of ISO 10303 shall include ISO 10303-1 and ISO/IEC 8824-1 in the list of normative references. All implementation methods, integrated resources, application protocols, and application interpreted constructs shall also include a reference to ISO 10303-11. The full reference for ISO/IEC 8824-1 is:

[ISO 10303 required]
ISO/IEC 8824-1:1995, *Information Technology - Open Systems Interconnection - Abstract Syntax Notation One (ASN.1) - Part 1: Specification of Basic Notation.*
[end required]

This is an example of the use of an existing ISO standard as a normative reference. Another example follows:

ISO 690:1965, *Documentation - Bibliographic references - Content, form, and structure.*
An example of the use of a part of the initial release of ISO 10303 specified as a normative reference follows:

ISO 10303-11:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 11: Description methods: The EXPRESS language reference manual.*
An example of the use of a part of ISO 10303 which has not been published as a full International Standard specified as a normative reference follows:

ISO 10303-45:— [1] *Industrial automation systems and integration - Product data representation and exchange - Part 45: Integrated generic resource: Materials*.
The title shall be in italics, but the standard number shall not. The footnote is part of the example and is required for any standard that has not reached full International Standard status.

[1)] To be published.

4.3.2 Technical normative elements

4.3.2.1 Terms and Definitions

The Terms and definitions clause is normative, but shall not contain requirements. Each term being defined shall occupy its own numbered subclause. The heading for the subclause shall be the term being defined. The subclause number shall appear in boldface and in 11 point type. On a new line shall be the term in boldface and in 11 point type. On another new line shall appear the definition in 11 point type. The clause number, term and definition shall begin flush with the left margin. Reference 3.1.1 as a model for this structure.

> NOTE - The use of 11 point type for definition headings is a deviation from the usual requirement to use 14 point type for headings.

The definition shall take the form of a noun clause in which the term being defined should not appear. The first word of the noun clause shall be in lower case unless it is a proper noun. The noun clause may be followed by one or more sentences if necessary. Notes may be used but such cases should be the exception. Reference annex C as a guide for writing definitions.

If definitions appear elsewhere in a part of ISO 10303, they shall follow the format outline in the previous paragraphs.

The clause heading for terms and definitions shall be one of the following:

— Clause 3 contains terms and definitons only

[ISO 10303 required]
3 Terms and definitions
[end required]

— Clause 3 contains terms, definitions, and abbreviations

[ISO 10303 required]
3 Terms, definitions, and abbreviations
[end required]

— Clause 3 contains terms, definitions, and symbols only

[ISO 10303 required]
3 Terms, definitions, and symbols
[end required]

— Clause 3 contains terms, definitions, abbreviations, and symbols

[ISO 10303 required]
3 Terms, definitions, abbreviations, and symbols
[end required]

In general, the Terms and definitions clause will contain at least two subclauses: terms defined in ISO 10303-1, and terms defined in the part of ISO 10303 being written. Certain parts of ISO 10303 may find it necessary to refer to definitions in other parts of ISO 10303 or in other International Standards. For the terms that are defined in other documents use the following text as a model for the subclause:

[ISO 10303 required]

3.1
Terms defined in ISO 10303-1

For the purpose of this part of ISO 10303, the following terms defined in ISO 10303-1 apply.
[end required]

This is followed by a list (see 4.1.7) of the terms in alphabetical order without their definitions. This same form may be used for terms defined in others parts of ISO 10303 or in other standards. The part of ISO 10303 or other standard so referenced shall be included in the Normative reference clause. Reference 3.1 as a model for this structure.

Particular attention should be paid to the list of definitions in ISO 10303-1. If any terms defined there are used in the document, they shall be included in this list.

A separate subclause of this form shall be used for each document from which definitions are drawn. This should be followed by a subclause with the definitions of the terms defined in this part of ISO 10303. A model for this subclause is:

[ISO 10303 required]

3.2
Other terms and definitions

For the purposes of this part of ISO 10303, the following definitions apply:
[end required]

followed by a series of numbered sub-subclauses in alphabetical order of the terms being defined.

If a term has an abbreviation, the term being defined shall be given in full and shall be followed by its abbreviation in parenthesis in boldface. Reference 3.1.4 for a model of this definition or use the following model:

[ISO 10303 required]
3.1.1
application reference model (ARM):
<definitiom>
[end required]

The abbreviation shall also appear in the Symbols and abbreviations clause or subclause. Indents, hanging indents, and tabs shall not be used. All definitions shall end with a full stop (period). The words defined in this subclause and their numbers shall appear in the Contents.

For definitoins that have been extracted from another document that is not a standard, the definition shall be followed by a note of the following form:

[ISO 10303 required]
NOTE - Adapted from <reference to the document> [n]
[end required]

Where [n] is a reference to the bibliography (see 4.4.2).

For terms that have commonly used synonyms, the synonyms shall be listed after the term's definition. Each synonym shall be separated from its predecessor by a semicolon as in the following example:

EXAMPLE - <**part-specific term**>**;** <**synonym**>**:** <Definition . . . .>

The clause title shall be "Definitions" even if the list consists of only one item.

4.3.2.2 Symbols and abbreviations

This is an optional element that provides a list of the symbols and abbreviations necessary for the understanding of the standard. This element may be combined with the previous element if both elements are short. If combined, the title of the clause shall be "Definitions, symbols, and abbreviations" or "Definitions and symbols", or "Definitions and abbreviations", as appropriate.

Use the following wording to introduce this element:

[ISO 10303 required]
For the purposes of this part of ISO 10303, the following symbols and abbreviations apply:
[end required]

NOTE - If either symbols or abbreviations are not present, remove the corresponding words from the phrase.

The symbols and abbreviations shall be given in two left-justified unbolded columns without punctuation. Capitalization shall correspond to the use of the abbreviation. The left column shall be indented five spaces from the left margin. The right column shall contain the phrase corresponding to the symbol or abbreviation.

The following abbreviations may be used in the text without definition; do not list these abbreviations in this clause:

— ISO;

— 2D;

— 3D;

— IEC.

4.3.2.3 Requirements

This element specifies those provisions that shall be satisfied to claim compliance with an International Standard. The following types of provisions constitute requirements:

— all characteristics relevant to the aspect(s) of the product(s), process(es) or service(s) covered by the standard, either explicitly or by reference;

— the required limiting values of quantifiable characteristics;

— for each requirement, either a reference to the test method for determining or verifying the values of the characteristic or the test method itself. (This is a requirement specified in the ISO Directives Part 3 and may not apply to parts of ISO 10303.)

There shall not be a clause in parts of ISO 10303 titled "Requirements." Titles for this element are found in clauses 6, 7, 8, and 9 of this standing document.

See clauses 6, 7, 8, and 9 of this standing document for details on the requirements for specific series of parts of ISO 10303.

4.3.2.4 Normative annexes

Normative annexes are essential parts of an International Standard and are the last normative elements; they are placed before the informative annexes. The fact that an annex is normative shall be made clear by a statement to this effect in the Foreword and by an indication in the heading of the annex itself.

4.3.2.4.1 Annex headings

The first word of the first heading in each annex shall be "Annex" followed by a space and a capital letter designating the serial order of the annex. This order shall begin with the letter "A" and continue through the alphabet bypassing the letter "I". The heading shall be in 14 point size, in boldface, and centred on the line. On the next line, the word "normative" or "informative" shall appear in parentheses and shall be followed by a blank line. The parentheses and the word "normative" or "informative" shall be in the same font and point size as the annex heading and shall be centred on the line but shall not be in boldface. The title of the annex shall be centred on the line and shall be in boldface on a line below the blank line that follows the word (normative) or (informative). A single annex shall be called "Annex A." A model for an annex that is normative is:

[ISO 10303 required]

Annex <N>
(normative)

Title of annex

Text . . .
[end required]

Replace <N> with the correct letter for the annex.

4.3.2.4.2 Numbering within annexes

Each number that precedes a clause or subclause of an annex shall be preceded by the letter that identifies that annex and a full stop. (For example, the numbers within annex A shall be preceded by the letter "A" followed by a full stop). With the addition of the letter denoting the annex, the rules as described in 4.1.5.1 shall be followed to number clauses and subclauses of annexes.

4.3.2.4.3 Information Object registration annex

All parts of ISO 10303 shall have at least one normative annex. This annex defines the information object identifier for the part as specified by ISO/IEC 8824-1 and shall be the final normative annex in each part. As a consequence, all parts of ISO 10303 shall specify a normative reference to ISO/IEC 8824-1. See 4.3.1.3 for the form of this reference.

4.3.2.4.4 Contents reference to annex

All annexes are references in the table of contents of the document. In the contents the annex reference is left justified. The first word of the contents shall be “Annex” followed by a space and a capital letter designating the serial order of the annex, followed by a space and the text “(normative)” or “(informative)” (see 4.3.2.4.2), followed by a space and the title of the annex.

The form of this annex varies according to the series to which the part belongs. Details are given for the integrated resources, application interpreted constructs, and application protocols. Other parts shall provide at least the following:

[ISO 10303 required]

Annex <N>
(normative)

Information object registration

To provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard 10303 part(nn) version(1) }

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.
[end required]

Replace <N> with the correct letter for the annex. The correct value for (nn) is the number of the part.

Part 1 of ISO 10303 has of necessity a slightly different approach to this annex. Other parts that include EXPRESS schemas shall follow the format described in 6.6.1.2. Where further information object type identifiers are to be defined, consult with the Quality Committee for an object type number and follow a similar form as that used for schemas.

See 6.6.1, 7.5.1, 8.8.1 for other normative annexes that may be included.

4.4 Supplementary elements

Supplementary elements provide information to assist in understanding a standard. These elements shall not contain requirements.

4.4.1 Informative annexes

Informative annexes give additional information and are placed after the normative elements of a standard. They shall not contain requirements. The fact that an annex is informative shall be made clear by a statement to this effect in the Foreword and by an indication in the heading of the annex itself. The format for the heading for informative annexes is given in 4.3.2.4.1. A model for an annex that is informative is:

[ISO 10303 required]

Annex <N>
(informative)

Title of annex

Text . . .
[end required]

Replace <N> with the correct letter for the annex.

See 4.3.2.4.1 and 4.3.2.4.2 for additional guidelines for the format for informative annexes.

4.4.1.1 An annex of examples

When an annex contains only examples, the point size for the text of the annex shall be the regular size (11 point) and not the point size normally required for text of examples (10 point). Examples shall not be indented in this annex. This annex is informative.

See clauses 6, 7, and 8 for informative annexes that may be included in the various series of parts of ISO 10303.

4.4.2 Bibliography

If included, the bibliography shall be an element of the standard that shall appear after the last annex and before the index. The bibliography shall contain a list of reference documents that provide further explanation of the concepts contained in the part or constitute "further reading." Entries in the bibliography shall be numbered using Arabic numbers enclosed in brackets. The format for bibliography entries is as follows:

— Author's last name all in capital letters followed by a comma. Author's first name or initials in capital letters followed by a semicolon. If there are more than three authors, list two or three and follow with "et al.";

— Title of publication in italic;

— Subordinate responsibility (such as "edited by . . . :);

— Edition;

— Publication (place, publisher);

— Standard number, if applicable.

To use a part of ISO 10303 or another International Standard as an entry in the bibliography, use the same format as that presented in 4.3.1.3. However, precede each entry with a number as explained in the first paragraph of this subclause. For further information on how to reference information in a bibliography, refer to ISO 690.

Entries in the bibliography shall be numbered, and listed alphabetically. A semi-colon shall be inserted at the end of each segment of an entry, i.e., author; title; edition; publication. Each entry should end with a full stop.

ISO and/or IEC standards are ordered by their standard designation. IEC standards precede ISO standards, which precede ISO/IEC standards. Other standards are also ordered by their standard designation. Books or documents with a known author are ordered by the surname of the (first) author. Books or documents without a known author are listed by the first word of the title (ignoring any initial definite or indefinite article).

EXAMPLE The following is an example of a Bibliography showing all the possible types of entry and their required order.

1. IEC xxxxx ...
2. ISO yyyyy ...
3. ISO/IEC zzzzz ....
4. BSI pppp ...
5. DIN qqqq ...
6. CARROLL, Lewis. Alice's Adventures in Wonderland ...
7. O'BRIEN, FLANN. The Third Policeman ...
8. Guidelines for the development and approval of ISO 10303 Application Protocols ...
9. Supplementary Directives ...

References to the bibliography in the rest of a part of ISO 10303 shall be given in a note. The note shall be worded to point the reader to the bibliography and the correct citation in it. A reference to an item the Bibliography consists of a short textual reference to the document (such as the name of the author(s), or the number of a standard), followed by the serial number of the referenced document as it appears in the Bibliography. Enclose the serial number in brackets. An example for wording that may be used to prepare that note follows.

EXAMPLE 1 - A bibliography for this standing document is on page 113. The complete citation for [n] is listed in that bibliography. <Replace [n] with the proper citation from the bibliography.>

EXAMPLE 2 - This example is taken from a standard that makes reference to ISO 10303-41 informatively (such as in an note) but does not make any other normative reference to it. In this example ISO 10303-41 is the third item in the referenced Bibliography. The following text illustrates a reference to a standard in a Bibliography: The product_definition entity data type is defined in ISO 10303-41 [3].

4.4.3 Index

An Index, the final element of a standard, shall contain an alphabetic list of terms that appear in the main text and the page number on which each appears. The integrated resource, application interpreted construct, application protocol series have specific requirements for the Index (see 6.7, 7.6, and 8.9 respectively). The Index shall not contain EXPRESS entity attribute names. The Index shall be a directory of definitions, of items, not a concordance. Where there is a good case, other terms may be included.

NOTE - An Index is not an annex. It is simply an additional element that is the last element in the document.

4.4.3.1 Format for the index

The Index shall begin on a new page. The title "Index" shall appear in 14 point text in boldface flush with the left margin at the top of the first page of the Index. The terms contained in the Index shall be presented as a single column and shall consist of an alphabetical list of terms addressed in the part of ISO 10303, followed by dot leaders and the number of the page on which the term appears.

4.5 Tables, figures, notes, examples, and footnotes

Tables, figures, notes, examples, and footnotes may be used to further explain the technical content of parts of ISO 10303. All notes and examples are informative by definition.

4.5.1 Tables

Tables are normative if referenced from the main text and informative if referenced only from a note, example, or informative annex. Tables shall include a title and an identification number and may include a legend, if necessary.

4.5.1.1 Placement of tables

All tables should appear immediately following their first reference. Tables should appear on the same page as the first reference to the table if space and context permit. Otherwise, the table shall appear on the page immediately following the first reference.

Where a table appears on a page containing text, the table should, whenever possible, be placed at the top or bottom of the page. When a table must be placed in mid-page, it should be separated from the text by three blank lines both before and after the table. A table should not be placed in the middle of a paragraph. The top of a table printed in landscape style shall be at the left margin on either left or right-hand pages.

4.5.1.2 Format for tables

Each table shall be bordered by single lines unless the addition of these lines causes a table that would fit on a single page to be continued on another page. The headings for each column shall be in boldface, centred within the column, and separated from the elements of the column by a double line. See clause 4, table 1 for an example of the format for a table.

4.5.1.2.1 Numbering of tables

Tables shall be numbered with Arabic numbers beginning with 1. Except for annexes, the numbering is independent of the numbering of clauses, subclauses, and figures. Numbers of tables in annexes shall be preceded by the letter assigned to the annex and a full stop. The first table in annex A would be referred to as "Table A.1".

4.5.1.2.2 Capitalization of titles of tables

The first word in the title of all tables shall be capitalized. All other words in the titles shall be in lower case unless they are proper nouns.

4.5.1.2.3 Placement of table numbers and titles

Table numbers and titles are to be in boldface, in 14 point type, and centred above tables. The number shall follow the word "Table" and be followed by a space, a hyphen, a space, and the title of the table on the same line. Only the first letter of the first word of the title shall be capitalized. If a table is printed on a page in landscape style, the table number and title shall still appear above the table. Unless it appears in mid-page, there shall be one blank 11 point line before and after the title line. An example of a title line follows.

EXAMPLE -

Table 1 - Title of table

4.5.1.2.4 Continuation of tables

When a table must be continued on another page or pages, repeat the number of the table followed by the appropriate words from the following examples.

EXAMPLE 1 -

Table 1 (continued)

EXAMPLE 2 -

Table 1 (concluded)

4.5.1.2.5 Capitalization of column headings within tables

The first word in the heading of each column of a table shall begin with a capital letter.

4.5.1.2.6 Repeat of column headings within tables

If a table covers more than one page, the column headings shall be repeated on each page of the table.

4.5.1.2.7 Units in tables

If units are used in a column of a table, they shall be indicated underneath the headings, but above any of the elements, i.e., above the double line.

4.5.1.3 References to tables

All tables shall be referenced in the text at least once. Choose from the following wording to reference a table:

— given in Table 1;

— (see Table 1).

NOTE - The word "Table" is capitalized.

4.5.2 Figures

Figures are normative if referenced from the main text and informative if referenced only from a note, example, or informative annex. Figures shall include a title and identification number and may include a legend, if necessary.

4.5.2.1 Placement of figures

All figures shall appear immediately following their first reference. Figures shall appear on the same page as the first reference to the figure if space and context permit. Otherwise, the figure shall appear on the page immediately following the reference.

Where a figure appears on the same page as text, the figure shall, whenever possible, be placed at the top or bottom of the page. When a figure must be placed in mid-page, it shall be separated from the text by two blank lines before the figure, one blank line between the figure and the title, and two blank lines between the title and the text that follows. A figure shall not be placed in the middle of a paragraph.

The top of a figure printed in landscape style shall be at the left-hand margin on either left or right-hand pages.

4.5.2.2 Format for figures

All figures shall be line drawings, text, or a combination of both. Figures shall occupy the full width of the page and cover at least 40% of the available space on the page. Figures printed in landscape style shall occupy the entire page. The content of the figure shall be centred. Figures shall not contain shading. Text in figures shall be in 8 to 11 point. The point size of text shall be consistent across a set of figures.

4.5.2.2.1 Numbering of figures

Figures shall be numbered with Arabic numbers beginning with 1. Except for annexes, the numbering is independent of the numbering of the clauses, subclauses, and tables. Numbers of figures in annexes shall be preceded by the letter assigned to the annex and a period. The first figure in annex A would be referred to as Figure A.1.

4.5.2.2.2 Capitalization of figure titles

The first word in the title of all figures shall be capitalized. All other words in the title shall be in lower case unless they are proper names.

4.5.2.2.3 Placement of figure numbers and titles

Figure numbers and titles are to be in boldface, in 14 point type, and shall be centred below the figure. The figure and title shall be separated from each other by one 11 point blank line. The figure number shall follow the word "Figure" and shall be followed by a blank space, a hyphen, another blank space, and the title of the figure. Only the first word in the title is capitalized. The figure number, and title shall be on the same line. If the figure is printed on the page in landscape style, the figure number and title shall appear below the figure as the figure is read, i.e., along the right hand margin of the page. There shall be two 11 point blank lines after the title line.

EXAMPLE - The following is an example of the title line:

Figure 1 - Title of figure

4.5.2.3 References to figures

References to figures shall be included in the text before the appearance of figures. The following are examples of wording that can be used to reference figures.

— shown in Figure 3

— (see Figure 3)

NOTE - The word "Figure" is capitalized.

If a figure is referenced solely from a note or example, the figure shall be considered a part of the note or example and thus, is informative. In this case, it is important that the figure follow the note.

4.5.3 Notes

Notes may be used to give information that is essential to the understanding of the document. Notes may refer to normative elements or normative references, although notes are informative (unless they are notes within a normative table or a figure). Notes may be part of any element except the title page, the title, and footnotes.

4.5.3.1 Placement of notes

Notes shall be placed after the clause, subclause, or paragraph to which they refer.

4.5.3.2 Format for notes

Notes shall be separated from the body of the clause, subclause, or paragraph to which they refer by a single 11 point blank line. They shall be followed by a single 11 point blank line. They shall appear in 10 point font of the same typeface as used for normal text. A single note shall be preceded by the title NOTE - (hyphen) placed at the beginning of the first line of the text of the note. Fonts for examples are specified in 4.1.3.

If a clause or subclauses contains more than one note each note shall be preceded by NOTE <n> -and the text. <n> is to be replaced by the number of the note. The text of each note shall be preceded by an Arabic numeral and a hyphen at the beginning of its first line.

If two or more notes are grouped they shall be followed by one 10 point blank line.

All lines of a note shall be indented from the margin of the main text by five spaces. If a note contains more than one line of text, the second line of text shall begin beneath the first letter of the word NOTE.

4.5.3.3 Notes within tables and figures

Notes within tables and figures are treated differently from notes within the text. Notes within tables and figures may contain requirements only if the figure or table itself is normative. They shall be placed within the frame of the relevant table or immediately above the title of the relevant figure. A separate numbering sequence of Arabic numbers shall be used for the notes in each table and each figure.

4.5.4 Examples

Examples may be used for further clarification of items such as style for mathematical notation, documentation, dates, or references. Examples are informative.

4.5.4.1 Placement of examples

Examples shall be placed after the clause, subclause, or paragraph to which they refer.

4.5.4.2 Format for examples

Examples shall be separated from the body of the clause, subclause, or paragraph to which they refer by a single 11 point blank line. They shall be followed by a single 11 point blank line. They shall appear in 10 point font of the same typeface as used for normal text. A single example shall be preceded by the title EXAMPLE - (hyphen) placed at the beginning of the first line of the text of the example. Fonts for examples are specified in 4.1.3.

If a clause or subclauses contains more than one example each example shall be preceded by EXAMPLE <n> -and the text. <n> is to be replaced by the number of the example. The text of each example shall be preceded by an Arabic numeral and a hyphen at the beginning of its first line.

If two or more examples are grouped they shall be followed by one 10 point blank line.

All lines of a example shall be indented from the margin of the main text by five spaces. If a example contains more than one line of text, the second line of text shall begin beneath the first letter of the word EXAMPLE.

4.5.5 Footnotes

Footnotes may be used to give additional information; however their use shall be kept to a minimum. They shall not contain requirements. Footnotes may also reference other parts of ISO 10303 or documents that are informative.

4.5.5.1 Placement of footnotes

The text of the footnote shall be placed at the bottom of the page of the text to which it relates. The text of the footnote shall be separated from the main body of the document by a solid line approximately 5 cm. (two inches) in length that is left justified. Text of footnotes shall be in 8 point type and shall appear above the line on which the page number appears.

4.5.5.2 Format for footnotes

Footnotes are designated in text by a raised (superscripted) Arabic number followed by a right parenthesis: [1), 2)], etc. All footnotes shall be consecutively numbered throughout a part of ISO 10303 beginning with 1. The same raised (superscripted) Arabic number followed by a right parenthesis used for the footnote in the main body of the text shall be used to designate the footnote text. An example of such use may be found in clause 2.

4.6 References within text

References within the text shall be in one of the following forms.

4.6.1 References to this International Standard

The form "This International Standard..." shall be used only when the entire ISO 10303 International Standard is being referenced; if one part of the standard is being referred to, use the following form:

— "this part of ISO 10303" (reference to this part only);

— "ISO 10303-11" (reference to another part of ISO 10303).

NOTE - The word "part" used by itself refers to a manufactured object or piece part. When referring to one of the documents of ISO 10303, the wording should be "part of ISO 10303".

4.6.2 References to other International Standards and documents

Any publicly available document recognized by the international subcommittee as having wide acceptance may be normatively referenced. This included national and industry standards. When there is also an ISO standard, the ISO standard shall be used.

When referring to another International Standard from normative text, in the text, use "ISO" followed by the reference number only including the part number, if applicable; give the full title in the normative references clause. References to a particular element of another International Standard shall include the clause referred to as well as the reference number of the International Standard. If reference is made to an International Standard from informative text where that standard has not been given as a normative reference, the date of publication shall follow the reference number.

4.6.3 Reference to subdivisions of the text

Use "clause" only to refer to an entire clause. Do not use the words "subclause" or "reference." Use the following forms:

— in accordance with clause 3;

— according to 3.1;

— details as given in 3.1.1;

— (see 3.1.1);

— as described in 3.1.2;

— see annex B.

4.7 Punctuation of words in a series

When three or more words are grouped together in a series, a comma shall follow the word that appears before the conjunction that precedes the last word in the series.

> EXAMPLE - The following sentence is an example of this type of punctuation. "In the United States, dogwood, cherry, and red bud are three types of trees that bloom in the spring." The use of the comma after the word "cherry" and before the conjunction "and" is an example of this type of punctuation.

4.8 Acceptable wording

This subclause gives details on the wording to be used to explain requirements and recommendations.

4.8.1 Use of "shall" and "shall not"

The verbal forms "shall" and "shall not" are used to indicate requirements to be followed to conform to the standard and from which no deviation is permitted. The words “shall” and “shall not” shall be used in normative text and shall not be used in the introduction, foreword, notes, or examples, which are informative text.

"Shall" shall be used to denote the following:

— is to ...;

— is required to ...;

— it is required that ...;

— has to ...;

— only ... is permitted;

— it is necessary ....

"Shall not" shall be used to denote the following:

— it is not allowed (permitted, acceptable, permissible)...;

— is required to be not ...;

— is required that ... be not...;

— is not to be ....

Do not use "must" except to describe "unavoidable" situations. Do not use "may not" instead of "shall not" to express a prohibition.

NOTE - To express a direct instruction, such as referring to steps to be taken in a test method, use the imperative. For instance, "Use the imperative."

4.8.2 Use of "should" and "should not"

The words "should" and "should not" shall be used to recommend a particularly suitable possibility or course of action without excluding others.

"Should" shall be used to denote the following:

— it is recommended that ...;

— ought to ...;

"Should not" shall be used to denote the following:

— it is recommended that ... not;

— ought not to ....

4.8.3 Use of "may" and "need not"

The words "may" and "need not" are used to indicate a course of action that is permissible within the limits of the standard.

"May" shall be used to denote the following:

— is permitted;

— is allowed;

— is permissible.

"Need not" shall be used to denote the following:

— it is not required that ...;

— no ... is required.

Do not use "can" instead of "may" in this context. Do not use "possible" or "impossible" in this context.

NOTE - "May" signifies permission expressed by the standard, whereas "can" refers to the ability of a user of the standard or to a possibility open to him.

4.8.4 Use of "can" and "cannot"

The words "can" and "cannot" are used for statements of possibility and capability.

"Can" shall be used to denote the following:

— to be able to;

— to be in a position to;

— there is a possibility of;

— it is possible to.

"Cannot" shall be used to denote the following:

— to be unable to ...;

— to be not in a position to ...;

— there is no possibility of ...;

— it is impossible to ....

NOTE - "May" signifies permission expressed by the standard, whereas "can" refers to the ability of a user of the standard or to a possibility open to him.

4.8.5 Use of i.e., and e.g.,

When used, "i.e." (that is) and "e.g." (for example) shall be followed by a comma (,). If using "i.e.," the list that follows shall be all inclusive whereas "e.g.," shall only list some of the possibilities and shall only appear in a note or example.

4.8.6 Use of quotation marks

Quotation marks shall be used to set off words or phrases that may confuse the reader if not marked. See 4.8.1 through 4.8.4 for the use of quotations marks.

When used, quotation marks shall be double ("xx") rather than single (‹xx’).

4.8.7 Spelling

The spelling of names of organizations and their abbreviations shall be as used by those organizations in English, French, or Russian. For the text portion of the part, The Concise Oxford English Dictionary shall be used for spelling.

The following spelling rules shall apply:

— Numbers from one to nine shall be spelled out in words;

— The words "modelling" and "modelled" shall be spelled with two "l's".

Note the correct spelling of the following:

centre, colour, faceted, litre, metre, millimetre, neighbour

and the preferred spelling of the following:

instantiation

4.9 Hyphenation

In general, hyphenation should be used to improve readability and appearance. Hyphenation shall follow the Oxford English Dictionary. These special terms shall be hyphenated as follows:

— non-zero;

— two-dimensional, three-dimensional (may be abbreviated as "2D" or "3D");

— B-rep (boundary representation shall be spelled out the first time it appears in the text, followed by the abbreviation in parentheses, i.e., "(B-rep)". The term "B-rep" shall be added to the list of abbreviations;

— X-axis, Y-axis, and Z-axis.

This list will be enlarged as required. Abbreviations shall not be divided by a line break.

4.10 Words to avoid

Do not use any terms that are corporate trademarks. In particular, do not refer to DOS diskettes.

The following words should be avoided to provide editorial consistency:

— and/or: Rather than use this form, expand the explanation and present both cases;

— datums: The plural of "datum" is "data". If one is tempted to use "datums", change it to "datum point" or "datum line" or "datum plane" as the case may be;

— utilise: Use "use" instead.

4.11 Frequently used words

The following terms are used frequently in parts of ISO 10303. To ensure editorial consistency, they should be used only in precisely defined contexts.

— data:	"Data" is a plural noun and requires a plural verb, i.e, "data are" not "data is".
— construct(s):	Do not use this word without a qualifier. The term "resource constructs" is defined in part 1 of ISO 10303; use it only as defined there. "EXPRESS constructs" should not be used; use "EXPRESS declarations" or "elements" instead. Any other use of "construct" should have a qualifier and appear in the Definitions clause of the part first defining it.
— presentation:	Do not use "presentation" for "representation". "Presentation" should be restricted to situations with visual aspects.
— which	Do not use "which" in place of "that". "That" introduces a defining phrase; "which" introduces an informational phrase. See [1].
— if	If an "if" clause ends in a comma, do not follow it with the word "then."

— between/among	Use "between" to mean "exactly two;" use "among" to mean "two or more."
— part	The use of "part" may be confusing. To refer to a part of ISO 10303, always use "this part of ISO 10303."

5 EXPRESS presentation style

This clause gives rules and guidelines specific to documenting EXPRESS. The subjects covered are:

— Layout, that explains how to use indentation, blank lines, and other white space to produce an attractive and consistent layout;

— Style, that deals with naming conventions that are to be used for all schemas developed for this International Standard;

— Usage;

— EXPRESS-G diagrams.

See 6.5 for documentation requirements of EXPRESS material.

5.1 Layout rules

The layout rules explain how to use white space to produce a schema that has a uniform appearance. A uniform appearance helps the reader to find and use the material of interest.

To prevent unusual spacing, use left justification, not full justification. See 4.1.3 for text fonts to be used in documenting EXPRESS.

To prevent widows and orphans of EXPRESS statements, use block protection or conditional end of page liberally. Because of the variability of the size of EXPRESS declarations, no hard rule can be given for the number of lines to force on one page. Do not insert extra page breaks. (See 4.1.5.3 for rules on widows and orphans that pertain to EXPRESS statements.)

5.1.1 Organization of schema elements

Schema elements shall be written in the order given below. None of these elements are mandatory; only include these elements as needed. See 6.5.

— USE or REFERENCE statements;

— CONSTANTS;

— TYPE declarations;

— ENTITY declarations;

— RULES;

— FUNCTIONS and PROCEDURES.

5.1.2 Use of colon

When used in an attribute declaration, a space shall be placed in front of and following each colon. When used in a label, no space shall separate the label name from the colon. When a set of syntactically similar elements containing colons appear in succession, space shall be used to align the colons in tabular fashion, when possible.

5.1.3 Use of semicolon

A space shall not appear before a semicolon, and a semicolon shall not appear at the beginning of a line.

5.1.4 Commenting conventions

It is intended that the requirements for a part of ISO 10303, as described by the EXPRESS constructs, can be extracted from the source description of the part of ISO 10303 by regarding all material that is not part of the EXPRESS as comments. Accordingly, EXPRESS declarations (e.g., SCHEMA, ENTITY, TYPE, RULE, FUNCTION) shall be separated from the surrounding text by EXPRESS embedded remark markers ("(*" and "*)"). The opening marker shall appear by itself on the line immediately preceding the EXPRESS object description, and the closing marker shall appear by itself on the line immediately following the description of the EXPRESS object.

Material not intended to describe a requirement, such as examples or notes that include EXPRESS code, shall not use the "*)" and "(*" delimiters.

Tail remarks (--<text>) may be used to annotate portions of EXPRESS PROCEDURE or FUNCTION code or to annotate a specific field or statement if a reader's attention needs to be drawn to it. The functionality of complicated procedural code and obscurely named fields and mappings from the requirements that are not obvious shall be explained by this method.

5.1.5 SCHEMA layout

The SCHEMA keyword is written flush with the left margin at the current indentation on a new line. The name of the schema follows the keyword, separated by a space. All declarations within a schema begin at the same margin.

```
SCHEMA ...;

TYPE ...;

ENTITY ...;

END_SCHEMA;
```

5.1.6 USE and REFERENCE layout

If present, the USE or the REFERENCE statements immediately follow the SCHEMA statement. Use one of the following examples:

```
USE FROM s-name
     (e1
     e2);

REFERENCE FROM s-name
     (e1,
     e2);
```

```
EXAMPLE 1 - USE FROM application_context_schema          -- ISO 10303-41
            (application_context,
            application_protocol_definition);
```

```
EXAMPLE 2 - REFERENCE FROM measure_schema                -- ISO 10303-41
           (measure_with_unit);
```

ENTITY names shall appear on separate lines with five leading spaces, except for the line containing the first ENTITY name which shall have four leading spaces. If aliases are present and space on the line permits, spaces shall be used to align the AS tokens in tabular fashion.

5.1.7 CONSTANT layout

If present, CONSTANT declarations shall follow the USE or REFERENCE declarations. CONSTANTS shall appear in the same subclause as TYPES, and colons within these declarations shall be aligned. Use the following layout for CONSTANT declarations with a new margin, indented two spaces:

```
CONSTANT
     name1  : NUMBER := 1000;
     name21 : NUMBER := name1**2;
END_CONSTANT;
```

5.1.8 TYPE layout

Each defined type is declared within its own TYPE ... END_TYPE block. The type declaration shall follow the type keyword, separated by a space. The END_TYPE keyword shall be written on a line by itself, aligned with the word TYPE. In the case of SELECT or ENUMERATION types, space shall be used to align the names in a tabular fashion with the same indentation as for USE and REFERENCE (see 5.1.7). The following are examples of TYPE declaration layout:

```
TYPE name = SET OF ent;
END_TYPE;

TYPE name = SELECT
     (ent1,
     ent2);
END_TYPE;
```

```
TYPE name = ENUMERATION OF
     (enum1,
     enum2);
END_TYPE;
```

5.1.9 Algorithm layout

The RULE, FUNCTION, or PROCEDURE keyword shall be written at the current margin. The name of the algorithm follows the keyword, separated by a space.

Local declarations shall be written after the algorithm header and before any procedural code.

A tail remark (--<text>) shall precede a logical section of code to explain its purpose. Blank lines separate logically related sections of code.

The following example applies equally to RULES, FUNCTIONS, and PROCEDURES except for the form of the header and footer. Parameter lists, local declarations, and code body are dealt with separately.

EXAMPLE -

```
PROCEDURE procedure_name(parameter_list);

     LOCAL
          local declarations
     END_LOCAL;

     -- explains following section
     code body

     -- explains following section
     code body

END_PROCEDURE;
```

5.1.10 Formal parameters

Formal parameters shall be grouped by type. A space shall follow a comma. Semicolons shall be treated according to 5.1.3; colons are treated according to 5.1.2 except for the case of type labels where no space shall appear before or after the colon. There shall be no space between a FUNCTION or PROCEDURE name and the following open parenthesis.

EXAMPLE 1 -

```
FUNCTION func_name(a, b, c : INTEGER;
                   d, e, f : REAL;
                   x, y, z : AGGREGATE OF point) : REAL;

PROCEDURE proc_name(a, b, c : INTEGER;
                   d, e, f : REAL;
                   VAR x, y, z : AGGREGATE OF point);
```

EXAMPLE 2 - Example with type labels:

```
FUNCTION add(a, b : GENERIC:label) : GENERIC:label;
```

The parameters of a rule simply list the entities to which the rule applies.

EXAMPLE 3 - The parameters of a RULE simply list the entities to which the RULE applies.

```
RULE rule_name FOR (entity1, entity2, ...);
```

If this does not fit on one line, follow the layout convention for type statements.

5.1.11 Local variables

Local (variable) declarations shall be indented two spaces. Unlike attribute declarations, several local declarations that are of the same type may be declared on the same line.

```
LOCAL
     i, j, k : INTEGER;
END_LOCAL;
```

5.1.12 Code body

A related group of statements shall be separated by a blank line from other groups of statements. A tail remark shall precede the statement group to explain its purpose. Structured statements shall be indented two spaces:

EXAMPLE -

```
IF cond THEN
     statement;
ELSE
     statement;
END_IF;

REPEAT ...;
     statement;
     ...
END_REPEAT;

-- Choose the appropriate case

CASE ...;
     label : statement;
     label :
     BEGIN
          statement;
          statement;
          ...
     END;
END_CASE;

BEGIN;
     statement;
     ...
END;
```

5.1.13 ENTITY layout

The ENTITY keyword shall be written at the current margin on a new line. The name of the entity shall follow the keyword, separated by a space.

The SUPERTYPE phrase shall start a new line at a two-space indentation from the ENTITY keyword. The first element of the SUPERTYPE phrase shall be written on the same line. Continuation lines, if required, shall be indented one space. Additional elements shall be aligned with the first element. Note that compound elements (those enclosed within parentheses) should stay together on the same line, if possible. The SUPERTYPE phrase is written before the SUBTYPE phrase.

The SUBTYPE phrase shall start a new line at a two space indentation from the ENTITY keyword. The first element of the SUBTYPE phrase shall be written on the same line. Additional elements shall be aligned with the first element.

Explicit attributes shall be written one per line. The attribute name shall be indented two spaces. When there is more than one attribute the colons shall be aligned.

The DERIVE keyword shall be written on a line by itself and aligned with the ENTITY keyword. Derived attributes shall be written in the same manner as explicit attributes.

Each UNIQUE rule shall be written on a separate line and indented two spaces. The UNIQUE rule shall be written on a single line, if possible and shall be labeled. If a UNIQUE rule consists of more than one line, spaces shall be used to maintain an equal post-label indentation of the entire rule.

Each local domain (WHERE) rule shall be written on a separate line and indented two spaces. The WHERE rule shall be written on a single line, if possible and shall be labeled. If a WHERE rule consists

of more than one line, spaces shall be used to maintain an equal post-label indentation of the entire rule. The END_ENTITY keyword is aligned with the ENTITY keyword.

```
ENTITY entity_name
  SUPERTYPE OF (ONEOF(e1, e2)
                AND
                ONEOF(e3, e4));
  SUBTYPE OF (e5,
              e6);
  ea1         : ...;
  e_attrname2 : ...;
DERIVE
  d_attr3   : ...;
UNIQUE
  UR1: ea1;
  UR2: d_attr3, e_attrname2;
WHERE
  WR1: ea1 > 9;
  WR2: ODD(e_attrname2) OR e_attrname2
        IN [ 2, 4, 8, 16, 32, 64, 128, 4096, 8192];
END_ENTITY;
```

5.2 Style rules

The style rules deal with capitalization and the choice and use of names for objects in a schema. Except for attribute names, EXPRESS identifiers shall be unique across all parts of ISO 10303.

5.2.1 Use of case

EXPRESS reserved words shall be written in upper case letters; everything else should be written in lower case. However, proper names are capitalized as in writing English (e.g., Planck). Even though acronyms are usually written in capital letters, use lower case when writing in EXPRESS. In this way, anything that appears in lower case (or mixed case) is user-defined, and the definition can be sought elsewhere.

5.2.2 Names

An EXPRESS schema uses a large number of identifier names. Excluding comments, those names do not explicitly give definitions. Names are very suggestive. Therefore clarity, unambiguity, similarity, and uniqueness are important considerations in choosing an identifier name.

When choosing a name, the use that will be read most often takes priority. For example, the executable code of a function will not be reviewed very often, but the function name will be. Consequently, the name should read naturally in a domain (WHERE) rule rather than following the keyword FUNCTION. The choice does not depend on which happens to be written first: the one containing its use or its declaration. For the purposes of choosing a name, the use takes precedence.

For example, one may be tempted to write:

```
FUNCTION is_extension_supplied ()
```

but its invocation would be

```
IF is_extension_supplied ( ) THEN
```

which is clumsy. The is_ prefix should be removed, allowing the call to be read as a phrase in English as well as in EXPRESS. In general when choosing names, do the following:

— Avoid confusion with similar names in the immediate context;

— Keep length down if possible. Do not use prefixes and suffixes such as is_, a_, the_, _set, _array, _list;

— Use plural name forms for aggregates;

— Use nouns for names of objects;

— Use verbs for names of actions;

— Separate name components by underscores.

5.2.2.1 SCHEMA names

Schema names in the integrated resources shall end with "_schema". Schema names in application interpreted constructs shall begin with "aic_".

5.2.2.2 ENTITY names

Do not use the schema name as the prefix to an entity name: entity **units** of schema **x** is referred to as **x.units** from another schema. However, it is sometimes necessary to use the entity name as a suffix for subtype entities. For example, **b_spline_curve** and **b_spline_surface**. The suffix is necessary since **b_spline** alone would cause a name clash. In a like manner, the name of a supertype sometimes is useful as a prefix to a subtype name: **surface_of_revolution**, for instance.

The names used within an ENUMERATION type shall be distinct from the names of schemas, entities, and types. It is often appropriate for these to be adjectival, e.g. planar rather than plane. Different ENUMERATION types may contain the same name, however.

5.2.2.3 Attribute names

Do not use the entity name as a prefix of an attribute name. Attribute test of entity x is referred to as x.test from outside that entity scope.

Do not append _set, _array, _list to an attribute type. Use ’knots’ instead of ‹knot_array’.

Do not use the type name as the attribute name even though EXPRESS allows it. The attribute name should reflect the role the type is playing in the definition of the entity.

5.2.2.4 Abbreviations and acronyms

Abbreviations and acronyms can be confusing. Avoid them if possible. When they must be used (to avoid layout problems), care shall be taken to use them consistently and to document the full meaning. When an abbreviation or acronym is used, a comment shall be provided to give the full spelling.

5.2.2.5 Clashes of attribute and FUNCTION names

Attributes shall not have the same names as functions; such name conflicts are confusing in domain rules.

5.2.2.6 Clashes of ENTITY names and ENUMERATION values

Entities shall not have the same name as ENUMERATION type values; such name conflicts are illegal according to ISO 10303-11.

5.2.2.7 Plurals of

Where possible the use of plurals of EXPRESS object names should be avoided by alternate use of English; for example, "several instances of the **vertex** entity." Otherwise plurals of EXPRESS object

names may be made by simply adding an "s" (not in boldface) to the end of the name. This includes names for which the plural in English changes the spelling of the word. The plural of "vertex" would be "vertexs," not "vertices". Also, note that the plural of "schema" is "schemas," not "schemata."

5.3 EXPRESS usage style requirements

5.3.1 Use of local domain (WHERE) rules

WHERE rules are used for at least three different purposes:

— To state aspects of the definition of an entity in a formal manner. Typically these are tests that will be true by definition, whatever the attribute values are.

— To define the desired behavior of the entity with respect to certain known queries.

— To define tests that can be applied to an instance of the entity to ensure that it is a valid instance.

The following contains one of each of these uses (in the same order):

```
*)
ENTITY line;
     start = point;
     dir   = direction;
WHERE
     WR1: arc_length_extent(line) = infinity;
     WR2: coordinate_space(line) = coordinate_space(start);
     WR3: start.x > 0.0;
END_ENTITY;
(*
```

Of these three, only the third shall be used. The first WHERE rule should be added to the entity definition text while the second class should either be treated using derived attributes or left until a future version of EXPRESS provides a clearer means of establishing the behavioral characteristics of entity implementations.

Large functions that test several aspects of an entity should not be used. Split the function into several smaller functions.

5.3.2 Labelling of UNIQUE and WHERE rules

All UNIQUE rules shall have a label that is unique within the scope of all labels used within the entity. Unless an appropriate short English word can be used, the form of the label shall be URn where n is an integer giving the position of the rule in the list.

All WHERE rules shall have a label that is unique within the scope of all labels used within the entity. Unless an appropriate short English word can be used, the form of the label shall be WRn where n is an integer giving the position of the rule in the list.

5.3.3 Definition of constraints

An entity may be constrained by one of the following three methods:

— definition of the entity;

— formal proposition: a computable constraint written in EXPRESS;

— informal proposition: constraints that cannot be documented formally.

The constraints expressed in the definition, formal, and informal propositions blocks of an entity definition shall not be redundant. There shall be as little overlap as possible between the restrictions placed on the entity among these three types of constraints.

Any characteristics of the entity that are part of the definition and are unaffected by attribute values are true at all times and do not need to be reiterated in the constraints and propositions.

5.4 EXPRESS-G diagram style

Each EXPRESS-G diagram shall follow the format in annex D of ISO 10303-11 with additional rules listed below.

— If possible, each schema shall occupy one page. A schema may occupy more than one page, if necessary, and two schemas may occupy a single page if each fits onto one-half page.

— The typeface shall be the same as that used for general text.

— All text except attribute names, attribute types, and cardinality indicators shall be 10 point.

— Attribute names, attribute types, and cardinality indicators shall be 8 point.

— Each figure shall have a caption.

— Each page shall be numbered in accordance with 4.1.6.

— All entities shall be included.

— All select, enumeration, and defined-data types shall be included.

— Inter-schema references shall be used for both REFERENCEd and USEd references.

— The aggregate type of attributes and types shall be indicated when appropriate using the abbreviations L, S, B, A to indicate LIST, SET, BAG and ARRAY respectively.

— Cardinality of attributes and types shall be indicated when appropriate by appending the bound-spec to the aggregate abbreviation.

— Attributes ending on simple data types -- BINARY, BOOLEAN, LOGICAL, STRING, NUMBER, INTEGER, REAL shall not show the simple data type but instead shall terminate with the same open circle as used for emphasized direction.

— The "to" end of an emphasized direction of a relationship shall be indicated by an open circle. The relationship line shall not enter the circle.

— Relationship line styles shall be used. The thickness of a SUPERTYPE relationship line shall be twice that of the attribute relationship lines. Suggested weights are 2 point and 4 point respectively.

— Lines forming entity boxes, etc., shall be in 2 point.

— All dashed lines shall be comprised of lines and gaps with a "unit" length of 2 mm minimum and 4 mm maximum.

— All relationship lines shall be oriented either vertically or horizontally (no diagonal lines or curves).

— There shall be no boxes around EXPRESS-G diagrams.

— Inverse and derived attributes shall be included in the EXPRESS-G diagrams and indicated by "(INV)" and "(DER)" respectively.

6 Documentation of the integrated resource series of parts of ISO 10303

This clause gives rules and guidelines specific to documenting the integrated resource series of parts of ISO 10303. Each part of ISO 10303 that is a member of the integrated resource series defines integrated resource constructs with a different scope and shall be published separately. In many cases (e.g., title page), a given clause, subclause, or paragraph of a part that is a member of the integrated resource series will be no different from the corresponding clause or subclause in other parts of ISO 10303. In these cases, this clause will reference the proper subclause of clauses 4 or 5 of this standing document.

6.1 Documentation of introduction

In addition to the information outlined in 4.2.4, the introduction to a part of ISO 10303 in the integrated resource series shall include an overview of the technical content of the schema(s).

6.2 Documentation of scope

The Scope clause of a part of ISO 10303 in the integrated resource series describes the application area in the case of an application resource or domain in the case of a generic resource addressed by the schemas and restricts that application area or domain to provide a clear explanation of the technical boundaries addressed by the schemas. Instead of the wording given in 4.3.1.2, use the following to start the Scope clause of a part of ISO 10303 that is a member of the integrated resource series:

This part of ISO 10303 specifies the resource constructs for . . .

The primary mechanism for defining the scope of each part in the integrated resource series is a simple text explanation of the information content of the part. At the minimum, an integrated resource part shall contain a narrative description of the scope of the information represented by the schema. It should describe the application area being addressed and any boundaries, limits, or rules used to determine whether something is in scope.

6.3 Documentation of normative references

Each part of ISO 10303 that is related to the integrated resource constructs being documented shall be identified as a normative reference. A part of ISO 10303 containing a schema that is identified by a USE or REFERENCE EXPRESS statement in the integrated resource being documented is related and shall be listed as a normative reference.

6.4 Documentation of definitions, symbols, and abbreviations

The terms defined in this clause shall be those that are specific to the application area or domain defined by the scope, but are not among the objects defined within the schemas. See 4.3.2.1 and 4.3.2.2.

6.5 Documentation of requirements

The set of requirement clauses constitutes the bulk of the integrated resource constructs documentation.

6.5.1 General requirements

For parts of ISO 10303 that are in the integrated resource series, each schema shall be documented in a separate requirements clause. The title of each requirements clause shall be the schema name without the "_schema" suffix, with underscores replaced by spaces, and with the initial character in upper case.

When referring to the elements of the EXPRESS language, EXPRESS reserved words (i.e., SCHEMA, ENTITY, WHERE) shall appear as all caps.

All EXPRESS schemas shall be parsed with as many EXPRESS parsers as possible. Such parsers should conform to ISO 10303-11. All known syntax errors shall be corrected.

6.5.2 Components of requirements clause

Each requirements clause shall contain the following subclauses in the order given below:

x <schema name>
x.1 Introduction
x.2 Fundamental concepts and assumptions
x.3 <schema name> type definitions
x.4 <schema name> entity definitions
x.5 <schema name> rule definitions
x.6 <schema name> function definitions

If there is nothing contained in one of the subclauses, the subclause shall be omitted and the remaining subclauses renumbered accordingly.

6.5.3 Schema documentation requirements

The following rules shall apply to the documentation of the schema.

— The schema clause shall be introduced with the following wording:

[ISO 10303 required]
The following EXPRESS declaration begins the <schema name> and identifies the necessary external references.
[end required]

The <schema name> should be replaced by the name of the schema with initial lower case, with words separated by underscores, and with the "_schema" suffix appropriate to all integrated resource schemas. This wording shall appear immediately following the clause heading. If there are no external references, the words "and identifies the necessary external references" shall be omitted.

— The above text shall be followed by the schema declaration. The declaration shall include any directives (e.g., references) necessary for the schema. The declaration shall be of the form:

EXPRESS specification:

```
*)
SCHEMA <schema_1 name>;

REFERENCE FROM <schema_2 name>
     (<e1 name,
     e2 name>);
(*
```

— Where REFERENCE or USE statements occur, a note is placed following the schema declaration. The note identifies the parts of ISO 10303 where schemas identified by the use or reference keyword are documented. The note shall be of the following form:

NOTE - The schemas referenced above can be found in the following parts of ISO 10303:

<schema_1>	Clause <n> of this part of ISO 10303
<schema_2>	ISO 10303-42

The elements of the note are arranged in two left-justified columns, without punctuation.

6.5.4 Introduction to schema

The introduction to the schema shall include the objectives of the schema and a description of its major components and key concepts.

This subclause is primarily text but may contain figures. A figure that presents an overview of the entities contained in the schema is suggested and should be referenced from a note. A figure of the sub-type/supertype hierarchy is suggested. Such figures shall use EXPRESS-G.

Use the following wording to begin the introduction to each schema:

[ISO 10303 required]
The subject of the XXXX schema is . . . .
[end required]

6.5.5 Fundamental concepts and assumptions

The fundamental concepts and assumptions are declarations of fact about the subject area of the schema. These facts have been used as the basis for the development of the integrated resource and are essential to the understanding and use of the part.

Fundamental concepts and assumptions may be expressed in a general or structured form. The general form shall be text that describes the concepts and assumptions that underlie the schema. The structured form shall be a list formatted as described in 4.1.7.

Fundamental concepts that apply to the entire part covering multiple schemas shall be documented in an additional clause immediately following the Definitions and abbreviations clause. Extra clauses may be included if appropriate to precede collections of related schemas.

6.5.6 Type documentation requirements

The following rules apply to the documentation of types.

— Each type in the "<schema name> type definitions" subclause shall be a new subclause. The title shall be the name of the type exactly as it appears in the EXPRESS declaration (lower case with underscores). This name should not be abbreviated and should comprise, where possible, proper English words. The title shall be in boldface.

— The title shall be followed by a text description and any supporting material necessary to define the intent of the type. In particular, this should demonstrate how this type is different from any other similar type.

— If there is only one type declaration in a schema, the type declaration shall appear in a single subclause titled <schema name> type definition: <type name>.

— The EXPRESS declaration shall be given next, separated from the text by comment markers as described in 5.1.4. The title "EXPRESS specification:" and a blank line shall be placed immediately before the close-comment marker.

NOTE 1 - Rules concerning the presentation of EXPRESS language statements are given in clause 5.

— If the type is an enumeration of items, the items may be defined following the EXPRESS declaration. The title "Enumerated item definitions:" and a blank line shall follow the declaration. The definition shall be presented in the style specified in 4.3.2.1.

NOTE 2 - Definitions of enumerated items shall be given for clarity, unless the definition is given in the "Definition clause". If the definition is given in the "Definition clause", the reference should be included as a note.

— Formal propositions follow the EXPRESS declaration or the definition of enumeration items. Formal propositions are constraints that are computable, are written in EXPRESS, and are placed within the where clause of a type declaration. Each formal proposition shall be presented as follows:

a) The title "Formal propositions:" shall be followed by a blank line.

b) When there is a local rule label in the EXPRESS specification, each formal proposition shall start with the local rule label and be followed immediately by a colon and a single space. The label shall be in boldface.

EXAMPLE - **WR1**: The value of x shall be positive.

c) The ISO required verb forms (e.g., shall or should) shall be used. "Must" shall not be used.

d) Any additional explanation or examples shall be provided as a note or an example.

e) The order of appearance shall be the same as the order in the EXPRESS declarations.

Where a formal proposition constraint is a call to an EXPRESS function, the effect of the tests within that function as they are applied to this type should be briefly described. A statement that the function shall return true is not adequate. The evaluated result for a where rule of true or unknown is considered as satisfying the rule. It may be that a function used as a where rule will never return unknown.

— Informal propositions follow the formal proposition definitions. Informal propositions are uncomputable constraints that cannot or cannot reasonably be written in EXPRESS, although each informal proposition still represents a requirement. If an EXPRESS declaration exists or EXPRESS-like pseudo-code has been written, it may be included in an annex as a technical discussion. Each informal proposition shall be presented as follows:

a) The title "Informal propositions:" shall be followed by a blank line.

b) Each informal proposition shall be given a title. The title may be an EXPRESS declaration.

c) The ISO required verb forms (e.g., shall or should) shall be used. "Must" shall not be used.

d) Any additional explanation or examples shall be presented as notes or examples.

The explanation for each proposition should clearly state the conditions and requirements that shall be met by instances of the type.

6.5.7 Entity documentation requirements

6.5.7.1 Documenting a single entity

The following rules apply to the documentation of entities:

— Each entity shall be declared/defined in a "<schema name> entity definitions" subclause. See 6.5.7.2 for an allowed approach to subdivide this subclause.

— Each entity definition shall be a new subclause. The title of the subclause shall be the name of the entity exactly as it appears in the EXPRESS declaration (lower case with underscores). Note that this name should not be abbreviated and should comprise, where possible, proper English words. The title shall be in boldface. (See 4.1.5.1)

— If there is only one entity declaration in a schema, the entity definition shall appear in a single subclause titled <schema name> entity definition: <entity name>.

— The subclause title shall be followed by a single blank line. The definition of the concept and any supporting text necessary to define the intent of the concept is contained in the entity definition text. The intent of the concept is the definition of the entity. The concept name should be the entity name without underscores and not bolded. Examples may be provided to clarify the intent of the concept or to illustrate the population of the attributes of the entity. Examples follow the prose definition. Extra explanation and references to other sources for explanations should also be given as a note. If figures are provided, they should be included in the entity definition text. Unless referenced only from a note, figures are normative.

— The EXPRESS declaration for the entity follows the entity definition text. The declaration shall be delimited by comment markers as specified in 5.1.4. The underlined title EXPRESS specification: and a blank line shall be placed immediately before the close comment marker, i.e., "*)".

— Following the EXPRESS declaration, all attributes (both explicit and derived) shall be documented. The following rules apply to the documentation of attribute definitions:

a) The title Attribute definitions: shall appear and be followed by a blank line. This shall appear immediately before the first attribute definition.

b) The attributes shall be presented in the same order as they appear in the EXPRESS declaration.

c) The attribute definition shall be presented in the style specified in 4.3.2.1. The attribute name shall appear exactly as given in the EXPRESS declaration (complete with underscores). The text that follows shall describe the role of that attribute in the entity. If the attribute uses another entity or type, there is no need to give a definition for the referenced item.

NOTE 1 - If it appears necessary to redefine the referenced item, consider defining a new intersection entity.

c) Additional explanation should be given as notes.

d) Examples may also be given.

An outline example of the definition of an entity is shown in Table 2.

Table 2 - Prototype page for entity definition

x.x.x <ENTITY NAME>

xxxxx <entity definition text> xxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

EXPRESS specification:

```
*)
ENTITY xxxxxxxxxx;
     a : INTEGER;
     b: REAL;
UNIQUE
     UR1: a,b;
WHERE
     WR1: f(a,b);
END_ENTUTY;
(*
```

Attribute definition:

<attribute1 name>: xxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

<attribute2 name>: xxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Formal propositions:

UR1: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Informal propositions:

IP1: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

— Formal propositions follow the attribute definitions. Formal propositions are constraints that are computable and are written in EXPRESS. Formal propositions are represented by local rules (i.e., WHERE, UNIQUE, and INVERSE) in an entity declaration. The following rules apply to the documentation of formal propositions:

a) The title Formal propositions: shall appear followed by a blank line. This shall appear immediately before the first definition.

b) The rule label shall appear in boldface followed by a colon and a space. The colon shall not be boldface.

EXAMPLE 1 - **UR1**: The name shall be unique.

EXAMPLE 2 - **WR1**: The value of x shall be positive.

c) The ISO required verb forms (i.e., shall or should) shall be used. "Must" shall not be used.

d) Any additional explanation shall be presented as notes or examples.

e) The order of appearance shall be the same as the order in the EXPRESS declarations.

f) There shall be a one-to-one correspondence between local rules (i.e., where, inverse, and unique) and formal propositions.

g) Where a constraint is a call to an EXPRESS function, the effect of the tests within that function as they are applied to this entity shall be briefly described. A statement that the function shall return true is not adequate. An evaluated result for a where rule of true or unknown is considered as satisfying the rule. It may be that a function used as a where rule will never return unknown.

h) Formal propositions shall only be included where the result of the evaluation depends on the values of the attributes. If the formal proposition always returns true, it shall not be included as a formal proposition but rather should be included as part of the text definition of the entity.

— Informal propositions shall follow the formal proposition definitions. Informal propositions are constraints that cannot or cannot reasonably be written in EXPRESS, although each informal proposition still represents a requirement. If an EXPRESS declaration exists or EXPRESS-like code has been written, it may be included in an annex as a technical discussion.

The following rules apply to the documentation of informal propositions:

a) The title Informal propositions: shall be followed by a blank line;

b) Each informal proposition shall be given a title;

c) The ISO required verb forms (e.g., shall or should) shall be used. "Must" shall not be used;

d) Additional explanations shall be presented as notes;

e) Examples may also be given;

f) The explanation for each proposition should clearly state the conditions and requirements that shall be met by the entity.

— A reference to an attribute within a supertype of the entity may be explained with a note following the first use of the attribute name. The note shall be of the following form:

NOTE 2 - The attribute <a_name> is declared in the <e_name> entity of which this entity is a subtype.

Phrases that reflect particular implementation considerations, such as "inherited attribute," should not be used.

6.5.7.2 Ordering of entity definitions

Entities may be collected into logical groups in order to enhance the readability and understandability of the schema. If such groups are used (there shall be at least two such groups), the following structure should be used for the entity definition subclause.

x.4.1 <schema name> entity definitions: <logical group name 1>
x.4.2 <schema name> entity definitions: <logical group name 2>
x.4.3 <schema name> entity definitions: <logical group name 3>
...
x.4.n <schema name> entity definitions: <logical group name n>

All EXPRESS entities shall be at the same subclause level within each group.

All EXPRESS entities within a given functional grouping should be presented in an order that will aid understanding. An obvious and common ordering will present the EXPRESS entity according to the subtype/supertype hierarchy relationships among the entities.

If there is no other reasonable order, the entities shall appear in alphabetical order.

6.5.8 Rule documentation requirements

The following rules shall apply to the documentation of rules:

— All rules shall be declared/defined in the "<schema name> rule definitions" subclause.

— Each rule shall constitute a new subclause. The title shall be the name of the rule exactly as it appears in the EXPRESS declaration (lower case with underscores). This name should not be abbreviated and should comprise, where possible, proper English words. The title shall be in boldface.

— If there is only one rule declaration in a schema, the rule declaration shall appear in a single subclause titled <schema name> rule definition: <rule name>.

— The title shall be followed by a prose definition and any supporting text necessary to define the intent of the rule.

— The EXPRESS declaration shall follow the definition. The title "EXPRESS specification:" and a blank line shall be placed immediately before the close comment marker.

— The arguments of the rule shall be defined following the EXPRESS declaration. The title "Argument definitions:" and a blank line shall follow the declaration. The definition shall be presented in the style specified in 4.3.2.1.

— Each rule within the WHERE clause of the rule shall have a unique label. Unless an appropriate short English word can be used, the form of the label shall be Rn or WRn where n is an integer giving the position of the rule in the list. This label should not be the same as any label used in the entities to which the rule applies. Each WHERE clause of the rule shall be documented as a formal proposition.

— Where a rule is dependent on an unelaborated function or procedure, a note should be included as follows:

NOTE - This rule is based on an unelaborated EXPRESS <function/procedure>.

6.5.9 Function (procedure) documentation requirements

The following rules shall apply to the documentation of function (or procedure) definitions:

— All functions shall be declared/defined in the "<schema name> function definitions" subclause.

— Each function shall constitute a new subclause. The title shall be the name of the function exactly as it appears in the EXPRESS declaration (lower case with underscores). The name should not be abbreviated and should comprise, where possible, proper English words. The title shall be in boldface.

— If there is only one function declaration in a schema, it should appear in a single subclause titled <schema name> function definition: <function name>.

— The title shall be followed by a definition and any supporting text necessary to define the intent of the function.

— The EXPRESS declaration shall follow the definition. The title "EXPRESS specification:"and a blank line shall be placed immediately before the close comment marker.

— All arguments of the function (procedure) shall be defined. The definition shall be presented in the style specified in 4.3.2.1. The title "Argument definitions:" shall follow the EXPRESS declaration. The title shall be followed by a blank line and the definition of each argument.

Each definition shall include whether the argument is an input, output, or both, and enumerate and define any error conditions that may result from the function.

— When the EXPRESS declaration of a function is not or cannot be explicitly specified, an EXPRESS comment should replace the body of the function stating 1) why the appropriate EXPRESS language statements are missing and 2) what the function is intended to do.

6.5.10 Unelaborated EXPRESS functions and procedures

EXPRESS functions and procedures and their application to entities may be documented by three different methods according to the completeness of the specification included in the part. The following explains how they should be documented in integrated resources.

— Functions and procedures fully specified in EXPRESS shall be documented as follows.

EXAMPLE 1 - In a function or procedure subclause:

```
*)
FUNCTION function_name (x:INTEGER): LOGICAL;
     <function body in EXPRESS>
END_FUNCTION;
(*
```

EXAMPLE 2 - In an entity that uses a function or procedure:

```
*)
ENTITY ....
     ...
WHERE
     WR1: function_name(...);
     ...
END_ENTITY;
(*
 . . . . . .
```

Formal propositions:

```
WR1:  xxx;
```

— Functions and procedures that cannot or cannot easily be implemented in EXPRESS but can be implemented within a specific application system, shall be documented as follows:

In a function or procedure subclause:

```
*)
 FUNCTION function_name (x:INTEGER): LOGICAL;
     -- unelaborated function
     (* <text that explains what the function is
     supposed to do.  Note that the text is commented out
     between the function head and tail.>  *)
 END_FUNCTION;
(*
```

The tail comment should always be inserted as shown so that it will occur in the EXPRESS listing of annex A. See 6.6.1.

NOTE - An explanation of why the function was not elaborated may be placed in a note.

EXAMPLE - In an entity that uses a function or rule:

```
*)
ENTITY ....
     ...
WHERE
     WR1: function_name(...);
     ...
END_ENTITY;
(*
. . . . . .
```

Formal propositions:

```
WR1: function_name(...);
.......
```

NOTE - This proposition is based upon an unelaborated EXPRESS function or procedure.

A note should be included to indicate that an EXPRESS declaration for the function exists, but that it has not been elaborated.

— Functions or procedures that cannot be implemented at all, either within EXPRESS or within an application system, e.g., "manifold," shall be documented as follows:

In a function or procedure subclause:

a) If a function or procedure of this type is used by more than one entity, a subclause shall exist for it that explains the constraint. However, no EXPRESS declaration shall be given.

b) If the function or procedure applies only to a single entity, an explanation of it should only appear within the informal propositions of that entity.

EXAMPLE - In an entity that uses a function or procedure:

```
*)
ENTITY ....
  ...
WHERE
  ...
END_ENTITY;
(*
. . . . . .
```

Informal propositions:

<constraint name or title>
<constraint explanation> .....

6.5.11 End of schema declaration

The EXPRESS declaration shall be the last item of the last subclause within each schema clause.

```
*)
END_SCHEMA;  -- <schema name>
(*
```

6.6 Documentation of annexes

The following subclauses describe the normative annexes that are part of an integrated resource and the informative annexes that shall and may be included.

6.6.1 Normative annexes

There are two normative annexes required for parts of ISO 10303 in the integrated resource series:

— Short names of entities (annex A)

— Information object registration (annex B)

6.6.1.1 Short names of entities (annex A)

Annex A shall contain a table of the correspondence between the entity names defined in the schema with the short form of these names. Each document containing EXPRESS shall contain this annex. The title of this annex shall be "Short names of entities". The table shall be given in two left justified columns, unbolded, with appropriate capitalization. The first column shall contain the long names (as given in the main body of the part) in alphabetical order, and the second column shall contain the short names.

Use the following text and format to document short names. See rules for creating tables in 4.5.1.

[ISO 10303 required]
Table A.1 provides the short names of entities specified in this part of ISO 10303. Requirements on the use of the short names are found in the implementation methods included in ISO 10303.
[end required]

NOTE - The ISO TC 184/SC4 Secretariat produces the short names which will be generated after the EXPRESS parses correctly. Project teams may propose short names however, they are subject to Quality Committee review.

Table A.1 - Short names of entities

Entity names	Short names

6.6.1.2 Information object registration (annex B)

In order that aspects of ISO 10303, including the parts of the standard and identifiable units within them such as schemas, can be unambiguously identified, ISO 10303 is making use of the object identifier and registration scheme defined in ISO/IEC 8824-1. All parts of ISO 10303 shall define the unique identifier for that part as the final normative annex as defined in 4.3.2.4.3. As a consequence, all parts of ISO 10303 shall have a normative reference to ISO/IEC 8824-1.

For integrated resources that contain one schema, the form for the annex follows. For document identification change the following:

sssss: the integer identifier for the ISO standard number. This identifier does not include the part number of the standard.

ppp: the integer identifier for the part number of the ISO standard.

v: the integer identifier for the version of the standard. The version number of the first edition of the standard shall be 1; subsequent modifications of the standard, whether by way of corrigenda, amendments or new editions shall have version numbers one larger than the previous versions.

> EXAMPLE 1 - { iso standard <sssss> part(<ppp>) version(<v>) } would be changed to { iso standard 10303 part(41) version(1) }.

> EXAMPLE 2 - The first edition of ISO 10303-41 has the version number 1. A technical corrigendum to the first edition results in a version number of 2.The second edition of ISO 10303-41 will have a version number of 3.

The version number shall be "1" for IS registration, "0" for DIS and FDIS registration, and "-1" for CD registration.

For schema identification change the following:

If the schema is unchanged from the schema in a previous version, its version number shall be unchanged. Otherwise, its version number shall be changed to reflect the new version number of the altered standard.

> NOTE this may result in some version numbers being unused for some schemas.

object: the integer identifier of the type of information object in the standard. The value "1" identifies the object as a schema. At the time of publication of this document, no other values have been assigned. In the future, SC 4 may assign other values of this field to identify other information objects, such as entities, defined types, or conformance classes.

> NOTE If further information object type identifiers are to be defined, consult with the Quality Committee for an object type number and follow a similar form as that used for schemas.

schema-name: name of the schema in which all occurrences of underscore (_) have been replaced by hyphen (-).

schema_name: name of the schema with underscore.

nn: an integer number that has been assigned to the schema. In the first version of a standard, these numbers shall be assigned sequentially to the schemas, from 1 to m. In subsequent versions of the standard, (whether through corrigenda, amendments or new editions) existing or modified schemas shall preserve this integer identifier. New schemas shall be assigned new values of the integer that have not been previously assigned. If schemas from previous versions of a standard are deleted from the standard, their values of this integer shall not be reassigned.

> EXAMPLE Corrigenda 1 to standard part nn, results in schema S1 changing to version 2 but leaves schema S2 unchanged at version 1. In the new edition of the standard (version 3) both schema S1 and S2 are changed; both are now reported as version 3 of the schema, even though there has never been a version 2 of schema S2.

[ISO 10303 required]

Annex B
(normative)

Information object registration

B.1 Document identification

To provide for unambiguous identification of an information object in an open system, the object identifier

> { iso standard <sssss> part(<ppp>) version(<v>) }

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

B.2 Schema identification

To provide for unambiguous identification of the <schema-name> in an open information system, the object identifier

> { iso standard <sssss> part(<ppp>) version(<v>) object(1) schema-name(<nn>) }

is assigned to the <schema_name> schema (see clause 5.2). The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO <sssss>-1.
[end required]

For integrated resources containing more than one schema, the form of the annex is given below. Make the same changes as the one schema case above.

[ISO 10303 required]

Annex B
(normative)

Information object registration

B.1 Document identification

To provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard <sssss> part(<ppp>) version(<v>)}

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

B.2 Schema identification

B.2.1 <schema_name> identification

To provide for unambiguous identification of the <schema_name> in an open information system, the object identifier

{iso standard <sssss> part(<ppp>) version(<v>) object(1) schema-name(1)}

is assigned to the <schema_name> schema (see clause 4). The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

B.2.2 <schema_name> identification

To provide for unambiguous identification of the <schema_name> in an open information system, the object identifier

{ iso standard <sssss> part(<ppp>) version(<v>) object(1) schema-name(2)}

is assigned to the <schema_name> schema (see clause 5). The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.
[end required]

For each schema increase the number in the last component of the identifier by 1 and increase the clause number.

6.6.2 Required informative annexes

The following informative annexes are required for integrated resources:

6.6.2.1 Computer interpretable listings (annex C)

Annex C shall provide electronic access to the list of short names provided in annex A and the EXPRESS specified in this part. This access is provided through the specification of URLs that identify the location of these files on the Internet. The EXPRESS file shall not contain any intervening prose; the EXPRESS listing for all schemas shall be found in one file. The listing shall not contain any comment delimiters of the kind "*)" and "(*" that separate the EXPRESS declarations from the main body of the prose. However, tail comments (those beginning with "--") may be included.

NOTE - The SC4 Secretariat will generate these files from the archive version prior to registration.

Use the following text (indented here to distinguish it from other text) and format for documenting this annex. In the URL for the EXPRESS, replace “nnn” in “partnnn” with the number of this part of ISO 10303 and “is” with the stage of the part. Confirm the URL with the SC4 Secretariat prior to publication.

[ISO 10303 required]
This annex references a listing of the EXPRESS entity names and corresponding short names as specified in this part of ISO 10303. It also references a listing of each EXPRESS schema specified in this part of ISO 10303, without comments or other explanatory text. These listings are available in computer-interpretable form and can be found at the following URLs:

Short names: http://www.mel.nist.gov/div826/subject/apde/snr/
EXPRESS: http://www.mel.nist.gov/step/parts/partnnn/is/

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

NOTE - The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

[end required]

6.6.2.2 EXPRESS-G diagrams (annex D)

The EXPRESS-G diagrams describing the schema(s) shall be included as a set of figures in annex D. Rules for formatting these diagrams are found in 5.4.

Use the following text to introduce the EXPRESS-G diagrams:

[ISO 10303 required]
The diagrams in this annex correspond to the EXPRESS schemas specified in this part of ISO 10303. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.
[end required]

Use the following form for the caption of each figure containing an EXPRESS-G diagram.

Figure <X>-<n> - EXPRESS-G diagram of the <schema_name> (<x> of< y>)

Where <X> is the annex number, <n> is the diagram number, and <x>,<y> are the ranges of the related figures for one schema.

6.6.3 Optional informative annexes

The following annexes are optional. They shall be lettered sequentially.

6.6.3.1 Model scope

Although the formal scope of the integrated resource series shall be documented in the normative clause entitled Scope, additional scoping material may be included as an informative annex. This annex shall not be used to document additional scope material for a single schema; such material should be included in the introduction
to the schema. (See 6.5.4.) This annex shall be solely to document additional scope information that crosses multiple schemas.

6.6.3.2 Bibliography

The bibliography, if included, shall contain a list of reference documents that provide further explanation of the concepts contained in the part or constitute "further reading." See 4.4.2 for the format to be followed to prepare the bibliography.

6.7 Documentation of the index

The index for the integrated resource series shall follow the guidance outlined in 4.4.3. The list of index items shall contain the location of the EXPRESS specification of each TYPE, ENTITY, FUNCTION, and RULE. The index item shall reference the page on which the EXPRESS specification is located and not the location of the clause number containing the EXPRESS specification. The index shall contain only a single index entry for each EXPRESS element. Each index item shall contain only a single page number for each EXPRESS element.

The index may contain additional reference information, however it shall not include the uses of an EXPRESS element.

7 Documentation of the application interpreted construct series of parts of ISO 10303

This clause gives rules and guidelines specific to documenting the application interpreted construct (AIC) series of parts of ISO 10303. Each part of ISO 10303 that is a member of the application interpreted construct series shall be documented separately. These documentation requirements supplement the requirements listed in the clauses 4 and 5 of this document. Information on the procedures for developing application interpreted constructs for ISO 10303 is provided in the *Guidelines for AIC Development*.

An outline for the contents of an AIC is shown in Table 3.

Table 3 - Contents of an application interpreted construct

Foreword (do not includ in table of contents)
Introduction (do not includ in table of contents)
1 Scope
2 Normative references
3 Definitions
4 EXPRESS short listing
    4.1 Fundamental concepts and assumptions
    4.2 <aic schema name> type definitions
    4.3 <aic schema name> entity definitions
    4.4 <aic schema name> function definitions

Annex A Short names of entities
Annex B Information object registration
    B.1 Document identification
    B.2 Schema identification
Annex C EXPRESS-G diagrams
Annex D Computer interpretable listings
• Technical discussions*

Bibliography*
Index

* These annexes or elements of the standard are optional and informative. Annexes shall be labeled in alphabetical order. If any of the optional annexes are omitted, adjust the labeling accordingly.

The elements of an application interpreted construct shall be documented in accordance with clause 4. In addition to the information outlined in 4.2.4, the introduction shall provide an overview of the technical content and the functionality of the AIC. The introduction may recommend informative references from the bibliography for additional information on the application domain.

7.1 Documentation of scope

The scope shall be documented following the format outlined in 4.3.1.2. In addition to the information outlined in 4.3.1.2, the Scope clause shall include a summary of the functionality of the AIC. Required wording to introduce the Scope clause follows:

[ISO 10303 required]
This part of ISO 10303 specifies the interpretation of the integrated resources to satisfy requirements for < AIC functionality >.

The following are within the scope of this part of ISO 10303: <populate list as appropriate>

— <types of products supported>;

— <types of product data>;

— <uses of the product data supported>;

— <accommodated discipline views of the product (e.g., electrical v.s. mechanical discipline views)>.

The following are outside the scope of this part of ISO 10303: <populate list as appropriate>

— <types of products not supported>;

— <types of product data not supported>;

— <uses of the product data not supported>;

— <unaccommodated discipline views of the product>.

[end required]

The preceding list may not apply to all AICs. If not applicable, do not include it.

7.2 Documentation of normative references

In addition to the information outlined in 4.3.1.3, the normative references shall include all other parts of ISO 10303 that are used by the AIC. ISO/IEC 8824-1, ISO 10303-1, and ISO 10303-11 shall be included in this list.

7.3 Documentation of definitions

In addition to the information outlined in 4.3.2.1, the definitions shall include any application-specific terms used in the Introduction and Scope clause. Where appropriate, terms defined in other documents should be listed with references to those documents and the definitions should not be repeated.

The list of terms referenced as being defined in ISO 10303-1 shall include, at a minimum, the following terms:

— application;

— application context;

— application protocol (AP);

— implementation method;

— integrated resource;

— interpretation;

— product data.

Required definition within the "Other definitions" subclause:

[ISO 10303 required]
3.x.1 application interpreted construct (AIC): a logical grouping of interpreted constructs that supports a specific functionality for the usage of product data across multiple application contexts.
[end required]

7.4 Documentation of EXPRESS short listing

The EXPRESS short listing shall contain the interface specification between the integrated resources and the AIC schema. This clause shall consist of a schema containing the EXPRESS USE FROM statements followed by any EXPRESS constructs that are unique to the AIC. The EXPRESS language statements shall appear in the following order: type, entity, function. Types, entity specializations, and functions that are specific to the AIC shall be defined in separate subclauses in the EXPRESS short listing. Where only one item is included at a given level in the structure (such as only one TYPE being defined), no additional level of subclause is required.

The following text shall be included as an introduction to the EXPRESS short listing:

[ISO 10303 required]
This clause specifies the EXPRESS schema that uses elements from the integrated resources and contains the types, entity specializations, and functions that are specific to this part of ISO 10303.

> NOTE - There may be subtypes and items of select lists that appear in the integrated resources that are not imported into the AIC. Constructs are eliminated from the subtype tree or select list through the use of the implicit interface rules of ISO 10303-11. References to eliminated constructs are outside the scope of the AIC. In some cases, all items of the select list are eliminated. Because AICs are intended to be implemented in the context of an application protocol, the items of the select list will be defined by the scope of the application protocol.

[end required]

After completion of the USE FROM statements, a note shall list the part of ISO 10303 where each schema identified in the USE FROM statements is documented. The note shall be of the following form:

[ISO 10303 required]
NOTE - The schemas referenced above can be found in the following parts of ISO 10303:

< schema_name_1 >	ISO 10303-<xx>
< schema_name_2 >	ISO 10303-<xx>

[end required]

The elements of the note are arranged in two left-justified columns, without punctuation.

The following text shall be included as an introduction to the Fundamental concept and assumptions clause:

[ISO 10303 required]
The following entities are intended to be independently instantiated in the application protocol schema that use this AIC:
[end required]

This would be followed by a list of entity names.

7.5 Documentation of annexes

The required annexes of an AIC are:

— A: Short names of entities (normative);

— B: Information object registration (normative);

— C: EXPRESS-G diagrams (informative);

— D: Computer interpretable listings (informative).

Annexes with the following titles may be included if appropriate:

— E: Technical discussions (informative);

7.5.1 Normative annexes

7.5.1.1 Short names of entities (annex A)

This annex shall be documented in accordance with 6.6.1.1.

7.5.1.2 Information object registration (annex B)

Each application interpreted construct shall include an annex giving information object identifiers as defined in ISO/IEC 8824-1. See 4.3.2.4.3 for details and the normative reference which is necessary to support this annex. For document identification change the following:

sssss: the integer identifier for the ISO standard number. This identifier does not include the part number of the standard.

ppp: the integer identifier for the part number of the ISO standard.

v: the integer identifier for the version of the standard. The version number of the first edition of the standard shall be 1; subsequent modifications of the standard, whether by way of corrigenda, amendments or new editions shall have version numbers one larger than the previous versions.

EXAMPLE 1 - { iso standard <sssss> part(<ppp>) version(<v>) } would be changed to { iso standard <10303> part(<514>) version(<1>) }.

EXAMPLE 2 - The first edition of ISO 10303-514 has the version number 1. A technical corrigendum to the first edition results in a version number of 2.The second edition of ISO 10303-514 will have a version number of 3.

The version number shall be "1" for IS registration, "0" for DIS and FDIS registration, and "-1" for CD registration.

For schema identification change the following:

sssss: the integer identifier for the ISO standard number. This identifier does not include the part number of the standard.

ppp: the integer identifier for the part number of the ISO standard.

v: the integer identifier for the version of the schema, The version number of the first version of the schema shall be 1; subsequent modifications of the schema, whether by way of corrigenda, amendments or new editions shall have version numbers one larger than the previous versions.

If the schema is unchanged from the schema in a previous version, its version number shall be unchanged. Otherwise, its version number shall be changed to reflect the new version number of the altered standard.

NOTE this may result in some version numbers being unused for some schemas.

object: the integer identifier of the type of information object in the standard. The value "1" identifies the object as a schema. At the time of publication of this document, no other values have been assigned. In the future, SC 4 may assign other values of this field to identify other information objects, such as entities, defined types, or conformance classes.

NOTE If further information object type identifiers are to be defined, consult with the Quality Committee for an object type number and follow a similar form as that used for schemas.

schema-name: name of the schema in which all occurrences of underscore (_) have been replaced by hyphen (-).

schema_name: name of the schema with underscore.

nn: an integer number that has been assigned to the schema. In the first version of a standard, these numbers shall be assigned sequentially to the schemas, from 1 to m. In subsequent versions of the standard, (whether through corrigenda, amendments or new editions) existing or modified schemas shall preserve this integer identifier. New schemas shall be assigned new values of the integer that have not been previously assigned. If schemas from previous versions of a standard are deleted from the standard, their values of this integer shall not be reassigned.

EXAMPLE Corrigenda 1 to standard part nn, results in schema S1 changing to version 2 but leaves schema S2 unchanged at version 1. In the new edition of the standard (version 3) both schema S1 and S2 are changed; both are now reported as version 3 of the schema, even though there has never been a version 2 of schema S2.

[ISO 10303 required]

Annex B
(normative)

Information object registration

B.1 Document identification

To provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard <sssss> part(<ppp>) version(<v>)}

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO <sssss>-1.

B.2 Schema identification

To provide for unambiguous identification of the <schema_name> in an open information system, the object identifier

{ iso standard <sssss> part(<ppp>) version(<v>) object(1) schema-name(<nn>) }

is assigned to the <schema_name> schema (see clause 4). The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO <sssss>-1.
[end required]

7.5.2 Required informative annexes

7.5.2.1 EXPRESS-G diagrams (annex C)

The EXPRESS-G diagrams shall be included as a set of figures in annex C. Rules for formatting these diagrams are found in 5.4.

Use the following text to introduce the EXPRESS-G diagrams:

[ISO 10303 required]
The diagrams in this annex are generated from the short listing given in clause 4 and correspond to the EXPRESS schemas specified in this part of ISO 10303. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

NOTE - The following select types: <select type1>, <select type 2>, and <select type n>, are interfaced into the AIC expanded listing according to the implicit interface rules of ISO 10303-11. These select types are not referenced by other entities in this part of ISO 10303.

[end required]

Use the following form for the caption of each figure containing an EXPRESS-G diagram.

Figure <X>-<n> - EXPRESS-G diagram of the <schema_name> (<x> of< y>)

Where <X> is the annex number, <n> is the diagram number, and <x>,<y> are the ranges of the related figures for one schema.

7.5.2.2 Computer interpretable listings (annex D)

Annex D shall provide electronic access to the list of short names provided in annex A and the EXPRESS specified in this part. This access is provided through the specification of URLs that identify the location of these files on the Internet. The EXPRESS file shall correspond to the short form provided in the body of the standard, without any intervening prose. The listing shall not contain any comment delimiters of the kind "*)" and "(*" that separate the EXPRESS declarations from the main body of the prose. However, tail comments (those beginning with "--") may be included.

NOTE - The SC4 Secretariat will generate these files from the archive version prior to registration.

Use the following text (indented here to distinguish it from other text) and format for documenting this annex. In the URL for the EXPRESS, replace "nnn" in "partnnn" with the number of this part of ISO 10303 and "is" with the stage of the part. Confirm the URL with the SC4 Secretariat prior to publication.

[ISO 10303 required]
This annex references a listing of the EXPRESS entity names and corresponding short names as specified in this part of ISO 10303. It also provides a listing of each EXPRESS schema specified in this part of ISO 10303 without comments or other explanatory text. These listings are available in computer-interpretable form and can be found at the following URLs:

Short names: http://www.mel.nist.gov/div826/subject/apde/snr/
EXPRESS: http://www.mel.nist.gov/step/parts/partnnn/is/

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

NOTE - The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

[end required]

7.5.3 Optional informative annexes

7.5.3.1 Bibliography

A bibliography may be provided as an informative element of the standard and shall be documented in accordance with 4.4.2.

7.5.3.2 Technical discussions

Relevant technical discussions may be provided as an annex. The format for this annex shall follow the format for the other annexes.

7.6 Documentation of index

In addition to the information outlined in 4.4.3, the index shall list the locations of each definition in clause 3 and the definitions of EXPRESS elements, i.e., TYPE, ENTITY, and FUNCTION.

For each AIC element, the index shall list the locations of the AIC short listing definition, and the location of the AIC element in the EXPRESS-G diagrams. The AIC element index entries shall appear in the following manner:

AIC_element_name
    AIC diagrams . . . .
    AIC EXPRESS short listing <plural_of_construct_type> . . . .

When the AIC element is an entity, replace <plural_of_construct_type> with "entities". When the AIC element is a type, use "types". When the AIC element is a rule, use "rules". When it is a function, use the word
"functions".

The index shall not include the _uses_ of an application object or AIC element.

8 Documentation of the application protocol series of parts of ISO 10303

This clause gives rules and guidelines specific to documenting the application protocol (AP) series of parts of ISO 10303. Each part of ISO 10303 that is a member of the application protocol series shall be documented separately. These documentation requirements supplement the requirements listed in clauses 4 and 5 of this standing document. Information on the procedures for developing application protocols for ISO 10303 is provided in the *Guidelines for the Development and Approval of STEP Application Protocols*.

An outline for the contents of an AP is shown in Table 4. Optional and informative annexes are indicated in Table 4 with an asterisk.

> NOTE - Annexes shall be labelled in alphabetical order. If any of the optional annexes are not included, adjust the labelling accordingly.

The elements of an application protocol shall be documented in accordance with clause 4. In addition to the information outlined in 4.2.4, the introduction shall provide an overview of the technical content and the application domain of the AP. The introduction may recommend informative references from the bibliography for additional information on the application domain.

8.1 Documentation of the Contents

The Contents for an AP shall follow the guidelines outlined in 4.2.2. The Contents for an AP shall contain entries to the second level (the first subclause level) except for the definitions of terms used in the AP and the units of functionality areas. The Contents shall contain entries to the third level in the definitions of terms used in the AP and the units of functionality areas.

Table 4 - Contents of an application protocol

Foreword (do not includ in table of contents)
Introduction (do not includ in table of contents)
1 Scope
2 Normative references
3 Terms, definitions and abbreviations
    3.n Abbreviations
4 Information requirements
    4.1 Units of functionality
        4.1.1 UoF1
        4.1.2 UoF2
        4.1.n UoFn
    4.2 Application objects
    4.3 Application assertions
5 Application interpreted model
    5.1 Mapping table
    5.2 AIM EXPRESS short listing
6 Conformance requirements

Annex A AIM EXPRESS expanded listing
Annex B AIM short names
Annex C Implementation method specific requirements
Annex D Protocol Implementation Conformance Statement (PICS) proforma
Annex E Information object registration
Annex F Application activity model
    F.1 Application activity model definitions and abbreviations
    F.2 Application activity model diagrams
Annex G Application reference model
Annex H AIM EXPRESS-G
Annex J Computer interpretable listing
Annex K Application protocol usage guide*
Annex L Technical discussions*

Bibliography
Index

* These annexes and elements of the standard are optional and informative. Annexes shall be labeled alphabetically.

If any of the optional annexes are omitted, adjust the labeling accordingly.

8.2 Documentation of scope

The scope shall be documented following the format outlined in 4.3.1.2. In addition to the information outlined in 4.3.1.2, the Scope clause shall include a summary of the application context and domain of the AP. Required wording to introduce the Scope clause follows:

[ISO 10303 required]
This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for <application purpose and context>.

NOTE - The application activity model in annex F provides a graphical representation of the processes and information flows that are the basis for the definition of the scope of this part of ISO 10303.

The following are within the scope of this part of ISO 10303:

— <types of products supported>;

— <types of product data>;

— <uses of the product data supported>;

— <accommodated discipline views of the product (e.g., electrical v.s. mechanical discipline views)>.

The following are outside the scope of this part of ISO 10303:

— <types of products not supported>;

— <types of product data not supported>;

— <uses of product data not supported>;

— <unaccommodated discipline views of the product.
[end required]

The preceding lists may not apply to all APs. Populate the lists as appropriate. If an item is not applicable, do not include it.

8.3 Documentation of normative references

In addition to the information outlined in 4.3.1.3, the normative references shall include all other parts of ISO 10303 that are used by the part being documented. APs using AICs shall include AICs that are referenced directly by the AP and indirectly referenced by directly referenced AICs (those AICs that are referenced by other AICs). ISO 10303-1 and ISO 10303-11 shall be included in this list.

8.4 Documentation of definitions

In addition to the information outlined in 4.3.2.1, the definitions shall include any application-specific terms used in the Introduction, Scope, and information requirements clauses but not defined in the information requirements clauses. The list of definitions shall not include objects defined within the application interpreted model. Where appropriate, terms defined in other normatively referenced documents should be listed with references to those documents and the definitions should not be repeated.

The list of terms referenced as being defined in ISO 10303-1 shall include, at a minimum, the terms from ISO 10303-1 that are found in the required text for the APs. The following terms shall be referenced from ISO10303-1:

— application;

— application activity model (AAM);

— application interpreted model (AIM);

— application object;

— application protocol (AP);

— application reference model (ARM);

— conformance testing;

— implementation method;

— integrated resource;

— PICS proforma;

— product;

— product data;

— unit of functionality (UoF).

8.5 Documentation of information requirements

This clause shall describe the functionality and information requirements of the application. This description is given in the language of the application but includes the terminology of data modelling. The information requirements shall include notes that reference the application activity model (annex F) and the application reference model (annex G) of the part being documented for explaining the relevance and roles of the required information.

The first paragraphs of this clause provide a high-level description of the information requirements that are supported by the AP. These information requirements may be organized by the different product types, life cycle phases, or application uses supported by the AP.

Use the following required text, including the notes, and format (indented here to distinguish it from other text) for documenting information requirements:

[ISO 10303 required]

4 Information requirements

This clause specifies the information required for <AP purpose>.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

NOTE 1 - A graphical representation of the information requirements is given in annex G.

NOTE 2 - The information requirements correspond to those of the activities identified as being within the scope of this application protocol in annex F.

NOTE 3 - The mapping table specified in 5.1 shows how the integrated resources <and application interpreted constructs> are used to meet the information requirements of this application protocol.

[end required]

8.5.1 Units of functionality

This subclause shall list and define the units of functionality of the AP. A unit of functionality (UoF) is a collection of application objects and relationships that conveys one or more concepts within the application context. The definition of a UoF shall include the scope of the UoF, a description of the functionality that the UoF supports, and the lists of application objects included in the UoF. The practice of nesting UoFs is strongly discouraged. Each application object shall appear in at least one UoF.

The following rules apply to the documentation of UoFs:

a) All units of functionality shall be presented in lower case with underscores where appropriate. This format is to be used for headings and references from the text. Boldface shall only be used in the headings.

b) All references to the unit of functionality shall be made as the <name of UoF> UoF.

c) Application objects included in each UoF shall be listed alphabetically.

Use the following required text and format (indented here to distinguish it from other text) for documenting UoFs:

[ISO 10303 required]

4.1 Units of functionality

This subclause specifies the units of functionality for the <title of the AP> application protocol. This part of ISO 10303 specifies the following units of functionality:

— <name of UoF 1>;

— <name of UoF 2>;

— <name of UoF 3>;

— <name of UoF 4>;

— <name of UoF n>.

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in 4.2.

4.1.1 <name of UoF 1>

<definition of UoF 1>

The following application objects are used by the <name of UoF 1> UoF:

— <application object 1>;

— <application object 2>;

— <application object 3>;

— <application object 4>;

— <application object n>.

4.1.n <name of UoF n>

<definition of UoF n>

The following application objects are used by the <name of UoF n> UoF:

— <application object 1>;

— <application object 2>;

— <application object 3>;

— <application object n>.

[end required]

8.5.2 Application objects

Each required application object shall be defined in a separate subclause. An application object is an atomic element that embodies a unique application concept and contains attributes that specify the data elements that the object is comprised of.

8.5.2.1 Format for application objects

The following rules apply to the documentation of application objects:

a) All application objects shall be presented with a leading upper case letter followed by lower case letters and underscores as necessary. This format shall be used for headings and references from text. Boldface shall be used when the object/attribute name is used in headings, but not in general text.

b) The text that follows the name of the application object shall consist of a description of the object defined within the context of the AP. If the object is in a supertype/subtype relationship, this fact shall be included in the description.

c) The definition of an application object shall be followed by the definitions of the attributes of that object.

d) The application objects shall be defined in alphabetical order.

e) Each application object shall be defined in a separate subclause.

8.5.2.2 Format for attributes of the objects

The following rules apply to the documentation of application object attributes:

a) All attribute names shall be presented as lower case letters and underscores as necessary. This format shall be used for headings and references from text. Boldface shall be used when the object/attribute name is used in headings, but not in general text.

b) The text that follows the name of the attribute shall consist of a description of the attribute defined within the context of the application object. If the attribute is an aggregate, optional or a logical, these facts shall be included in the description. In the case of a logical attribute, the terms “logical flag” or “logical indicator” shall not be used; both conditions that the attribute creates shall be indicated.

c) The attributes shall be defined in alphabetical order.

d) Each attribute shall be defined in a separate subsubclause. In the latter case, the definition shall immediately follow the object definition.

Use the following required text and format (indented here to distinguish it from other text) for documenting the application objects clause:

[ISO 10303 required]

4.2 Application objects

This subclause specifies the application objects for the <title of the AP(in lowercase)> application protocol. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

4.2.1 <Object_1>

A(n) <Object_1> is <description of the object within the context of the application. More than one sentence may be given here>.
[end required]

Or, in the case where the application object is a subtype in a supertype/subtype relationship the first sentence states the supertype the object is a subset of and provides a cross reference to the clause number of the definition of the supertype object.

[ISO 10303 required]
A(n) <Object_1> is a type of <Supertype_object_name> (see 4.2.n) <description of the object within the context of the application. More than one sentence may be given here>.
[end required]

For application objects that are a supertype in a supertype/subtype relationship, the recommended wording is an additional sentence that states the existence dependencies. Cross references are provided with the clause number of the definition of each of the subtype objects.

If the supertype is existence dependent on a subtype (IDEF1X complete categorization or EXPRESS ABSTRACT ONEOF supertype):

[ISO 10303 required]
Each <Object_1> is either a(n) <Subtype_object_name_1> (see 4.2.a), a(n) <Subtype_object_name_2> (see 4.2.c), ..., or a(n) <Subtype_object_name_n> (see 4.2.x).
[end required]

If the supertype is not existence dependent on a subtype (IDEF1X incomplete categorization or EXPRESS ABSTRACT ONEOF supertype):

[ISO 10303 required]
Each <Object_1> may be one of the following: a(n) <Subtype_object_name_1> (see 4.2.a), a(n) <Subtype_object_name_2> (see 4.2.c), ..., or a(n) <Subtype_object_name_n> (see 4.2.x).
[end required]

Or, for a single subtype:

[ISO 10303 required]
Each <Object_1> may be a(n) <Subtype_object_name> (see 4.2.a).

The data associated with a(n) <Object_1> are the following:

— <attribute_1>;

— <attribute_2>;

— <attribute_n>.

4.2.1.1 <attribute_1>

The <attribute_1> specifies the <role and nature of the attribute with respect to the object. More than one sentence may be given here.>
[end required]

For logical attributes, indicate both of the conditions that the attribute creates.

[ISO 10303 required]
The <attribute_1> specifies whether or not <condition the attribute creates with respect to the object. More than one sentence may be given here>.
[end required]

For optional attributes, include an additional sentence which states:

[ISO 10303 required]
The <attribute_1> need not be specified for a particular <Object_1>.
[end required]

For attributes that may be aggregated and are not assertions, include an additional sentence which states:

[ISO 10303 required]
There may be more than one <attribute_1> for a(n) <Object_1>.
[end required]

> EXAMPLE - Using EXPRESS-G modelling the aggregate may be a base type, using IDEF1X modelling the aggregate may be an attribute.

[ISO 10303 required]

4.2.1.2 <attribute_2>

. . .

4.2.2 <Object_2>

A(n) <Object_2> is .....

The data associated with a(n) <Object_2> are the following:

— <attribute_1>.

The <attribute_1> specifies the <role and nature of the attribute with respect to the object. More than one sentence may be given here.>
[end required]

8.5.3 Application assertions

This subclause shall define the relationships and cardinalities between the application objects defined in the previous clause. Application assertions should not be used to document subsets. If one application object is a (proper) subset of another application object, that fact should be included in the definition of the application object. Equivalently, the verbs "is" and "are" should not be used to express relationships.

The following rules apply to the documentation of application assertions:

— list application objects in assertions in primary or forward order; do not include converse assertions;

NOTE 1 - The primary order for an EXPRESS ARM is an entity with an attribute that contains a reference to an other entity, for an IDEF1X ARM it is the natural order from parent to child.

— order the assertions alphabetically by the first application object referenced;

— within the groups of assertions dealing with a given application object, order the assertions alphabetically by the second application object referenced;

— list the application assertion and its converse in a subclause;

NOTE 2 - The assertions state the cardinalities between objects.

— use a verb specific to the application to state the role between objects;

— add the plural “objects” to the end of the assertion if the cardinality of the assertion is greater than one or the assertion is "zero or one";

— list multiple assertions between objects under one heading with a blank line between the sets of assertions.

EXAMPLE - Each A supervises one or more B objects. Each B is supervised by exactly one A.

Use the following text and format (indented here to distinguish it from other text) for documenting the application assertions:

[ISO 10303 required]

4.3 Application assertions

This subclause specifies the application assertions for the <title of the AP> application protocol. Application assertions specify the relationships between application objects, the cardinality of the relationships, and the rules required for the integrity and validity of the application objects and UoFs. The application assertions and their definitions are given below.

4.3.1 <Abc_name> to <Bcd_name>

Each <Abc_name> <role_1> <cardinality_1> <Bcd_name> (objects). Each <Bcd_name> <inverse_-role_1> <inverse_cardinality_1> <Abc_name> (objects).

Each <Abc_name> <role_2> <cardinality_2> <Bcd_name> (objects). Each <Bcd_name> <inverse_-role_2> <inverse_cardinality_2> <Abc_name> (objects).
[end required]

8.5.4 Documentation of EXPRESS ARMS

EXPRESS ARMs require slightly different documentation guidelines than IDEF1X ARMs. With an EXPRESS ARM it is difficult to initially distinguish between attributes and assertions.

The application object is defined with all attributes including those that represent assertions in clause 4.2. Attributes that provide the assertions are also defined in clause 4.3 as the context or role within the application object that the attribute has. The attribute definitions in clause 4.2 provide a reference to the application assertion in clause 4.3 Inverse attribute relationships may be used for an entity attribute definition and shall be used to provide assertion information. For the example, clause 4 would look like the outline in **Figure 1**.

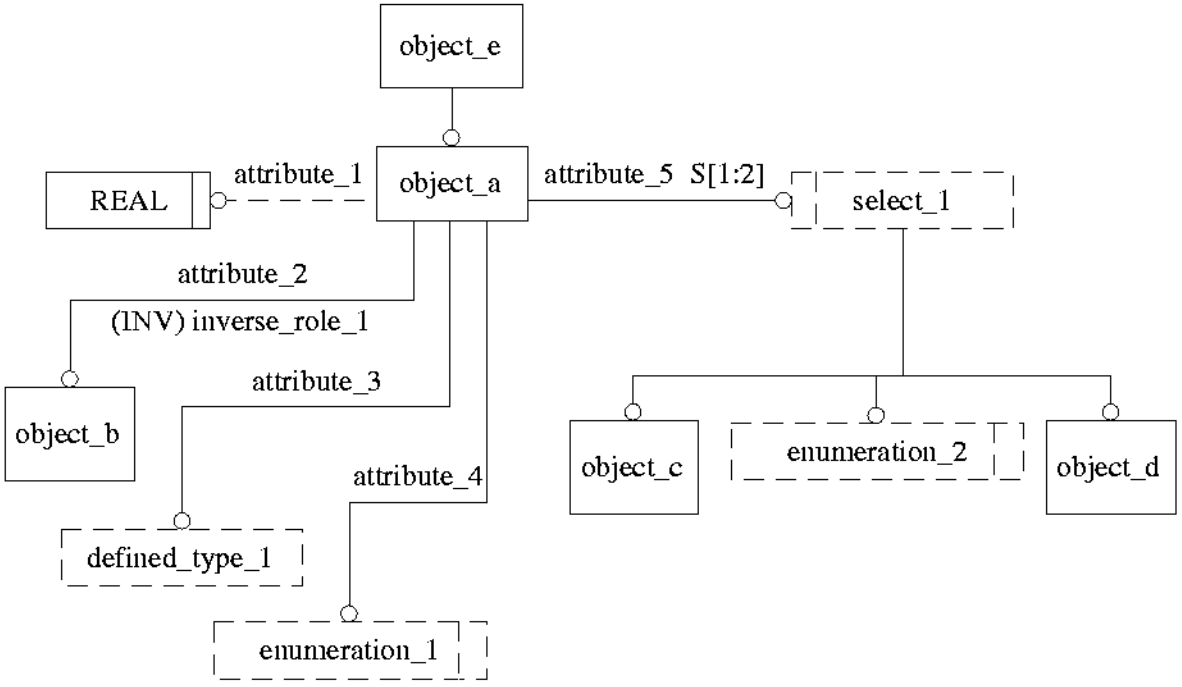

Figure G.1 - ARM diagram 1 of 1 in EXPRESS-G

[ISO 10303 required]

4.2.1 Object_a

An Object_a is a type of Object_e (see 4.2.5) that is <definition>. The data associated with an Object_a are the following:

— attribute_1;

— attribute_2;

— attribute_3;

— attribute_4;

— attribute_5.

4.2.1.1 attribute_1

The attribute_1 specifies <definition>. The attribute_1 need not be specified for a particular Object_a.

4.2.1.2 attribute_2

The attribute_2 specifies <context or role within object>. See 4.3.1 for the application assertion.

4.2.1.3 attribute_3

The attribute_3 specifies <define type definition>.

4.2.1.4 attribute_4

The attribute_4 specifies <definition>. The value of attribute_4 is one of the following:

— type_1;

— type_2.

NOTE - See 4.2.1.4.1 and 4.2.1.4.2 for the definition of each allowable value for attribute_4.

4.2.1.4.1 type_1

type_1: <definition>.

4.2.1.4.2 type_2

type_2: <definition>.

4.2.1.5 attribute_5

The attribute_5 specifies <definition>. Each attribute_5 may be one of the following: object_c (see 4.2.3), object_d (see 4.2.4). See 4.3.2 and 4.3.3 for the application assertion. Or the value of attribute_5 shall be one of the following:

— type_3;

— type_4.

NOTE - See 4.2.1.5.1 and 4.2.1.5.2 for the definition of each allowable value for attribute_5.

4.2.1.5.1 type_3

type_3: <definition>.

4.2.1.5.2 type_4

type_4: <definition>.

4.2.2 Object_b

An Object_b is <definition>.

4.2.3 Object_c

An Object_c is <definition>.

4.2.4 Object_d

An Object_d is <definition>.

4.2.5 Object_e

An Object_e is <definition>. An Object_e may be an Object_a (see 4.2.1).

4.3 Application assertions

4.3.1 Object_a to Object_b

Object_a has attribute_2 defined by exactly one Object_b. Object_b defines inverse_role_1 for exactly one Object_a.

4.3.2 Object_a to Object_c

Object_a has attribute_5 defined by one or two Object_c objects. Object_c defines attribute_5 for zero, one, or many Object_a objects.

4.3.3 Object_a to Object_d

Object_a has attribute_5 defined by one or two Object_d objects. Object_d defines attribute_5 for zero, one, or many Object_a objects.
[end required]

8.6 Documentation of the application interpreted model

The application interpreted model (AIM) specifies the use of the integrated resources and application interpreted constructs necessary to satisfy the information requirements and constraints of the application reference model.

8.6.1 Mapping table

Guidance on developing and documenting mappings tables for ISO 10303 application protocols is provided in *Guidelines for the development of the mapping tables*. The mapping table documents the correspondence between the information requirements defined in clause 4 and how the requirements are satisfied by the objects in the AIM. The mapping table is a series of subtables organised by units of functionality as defined in 8.5.1. The mappings for each UoF shall be documented in a separate subtable. The subtables shall be alphabetized by UoF name. Application objects not included in any UoF shall be listed in the final subtable which shall be titled “Additional application objects”.

The following rules apply to the documentation of the mapping table:

— The subclause title "Mapping table" shall be followed by a blank line.

— The title of the subtable shall be the word “Table <number of the table>” followed by a hyphen and “Mapping table for <name of the UoF> UoF”. The title shall be centred above the subtable as in 4.5.1.2.3.

— The border of each subtable shall be a single line. Column headings shall appear on each page of each subtable. The column headings shall be set off from the following entries by a double line. Application objects follow in alphabetical order (see Table 5). Each application object shall be specified on a single row of the table. Attributes and assertions for each object follow on separate rows of the subtable, separated from the previous row by a single line. Objects within a UoF shall be separated from each other by double lines in the table.

— The orientation of the mapping table shall be landscape.

— Each subtable shall have five columns. All information in these columns shall be from normative elements; no objects shall be used from an informative annex. The contents of the first column are to be left justified and the contents of the remaining columns are to be centred.

— When the mapping is to IDENTICAL MAPPING OR PATH, no source is provided.

The documentation of the mapping table for an EXPRESS ARM follows the above rules with the following exception. The application object is defined followed by all attributes which are not assertions. Assertions follow these attributes and include the name of the attribute that provides the assertion.

For an example of the ARM column of the mapping table see Table 5.

Use the following required text and format (indented here to distinguish it from other text) for documenting the mapping tables: (Because of the special characters used in the lists in the required wording, the format of the list shall be formatted as a second level list.)

[ISO 10303 required]

5.1 Mapping table

This clause contains the mapping table that shows how each UoF and application object of this part of ISO 10303 (see clause 4) maps to one or more AIM constructs (see annex A). The mapping table is organized in five columns.

Column 1) Application element: Name of an application element as it appears in the application object definition in 4.2. Application object names are written in uppercase. Attribute names and assertions are listed after the application object to which they belong and are written in lower case.

Column 2) AIM element: Name of an AIM element as it appears in the AIM (see annex A), the term `IDENTICAL MAPPING', or the term `PATH'. AIM entities are written in lower case. Attribute names of AIM entities are referred to as <entity name>.<attribute name>. The mapping of an application element may result in several related AIM elements. Each of these AIM elements requires a line of its own in the table. The term `IDENTICAL MAPPING' indicates that both application objects of an application assertion map to the same AIM element. The term `PATH' indicates that the application assertion maps to the entire reference path.

Column 3) Source: For those AIM elements that are interpreted from the integrated resources or the application interpreted constructs, this is the number of the corresponding part of ISO 10303. For those AIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part. Entities or types that are defined within the integrated resources have an AIC as the source reference if the use of the entity or type for the mapping is within the scope of the AIC.

Column 4) Rules: One or more numbers may be given that refer to rules that apply to the current AIM element or reference path. For rules that are derived from relationships between application objects, the same rule is referred to by the mapping entries of all the involved AIM elements. The expanded names of the rules are listed after the table.

Column 5) Reference path: To describe fully the mapping of an application object, it may be necessary to specify a reference path through several related AIM elements. The reference path column documents the role of an AIM element relative to the AIM element in the row succeeding it. Two or more such related AIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application object. For each AIM element that has been created for use within this part of ISO 10303, a reference path up to its supertype from an integrated resource is specified.

For the expression of reference paths and the relationships between AIM elements the following notational conventions apply:

a) []: enclosed section constrains multiple AIM elements or sections of the reference path are required to satisfy an information requirement;

b) (): enclosed section constrains multiple AIM elements or sections of the reference path are identified as alternatives within the mapping to satisfy an information requirement;

c) {}: enclosed section constrains the reference path to satisfy an information requirement;

d) <>: enclosed section constrains at one or more required reference path;

e) ||: enclosed section constrains the supertype entity;

f) ->: attribute references the entity or select type given in the following row;

g) <-: entity or select type is referenced by the attribute in the following row;

h [i]: attribute is an aggregation of which a single member is given in the following row;

i) [n]: attribute is an aggregation of which member n is given in the following row;

j) =>: entity is a supertype of the entity given in the following row;

k) <=: entity is a subtype of the entity given in the following row;

l) =: the string, select, or enumeration type is constrained to a choice or value;

m) \: the reference path expression continues on the next line.

[end required]

Table 5 - Mapping table for drawing_structure_and_administration UoF

Application element	AIM element	Source	Rules	Reference path
APPROVAL	approval	41		
date	calendar_date	41		approval <- approval_date_time.dated_approval approval_date_time approval_date_time.date_time ->date_time_select date_time_select = date date => calendar_date
description	approval.level	41		
approval to organization #1: If the approval is given by only a person #2: If the approval is given by only an organization #3: If the approval is given by a person within an organization	PATH			approval <- approval_person_organization.authorized_approval approval_person_organization approval_person_organization.person_organization ->person_organization_select #1 (person_organization_select = person person) #2 (person_organization_select = organization organization) #3 (person_organization_select = person_and_organization person_and_organization)
DRAWING	draughting_drawing_revision	201		draughting_drawing_revision <= drawing_revision
drawing_number	drawing_definition. drawing_number	101		draughting_drawing_revision <= drawing_revision drawing_revision.drawing_identifier ->drawing_definition drawing_definition.drawing_number

8.6.2 AIM EXPRESS short listing

The AIM EXPRESS short listing shall contain the interface specification between the integrated resources and AICs and the AP schema. Definitions of constructs that are imported from the integrated resources that are modified in the AIM shall be included in the AIM EXPRESS short listing. This clause shall consist of a schema containing the EXPRESS USE FROM statements followed by any EXPRESS constructs that are unique to the AP. The EXPRESS language statements shall appear in the following order: type, entity, rule, function. Types, entity specializations, rules and functions that are specific to the AP shall be defined in separate subclauses in the AIM EXPRESS short listing.

String literals that are used to convey application requirements in EXPRESS constructs are to be written in lower case with spaces separating words. For example, if a rule is written to constrain the allowable values of an attribute with base type string, an appropriately written value would be 'part number'.

Each modification to the definition of an imported type, entity, rule or function shall be defined in a separate subclause. Each subclause for type, entity, rule and function shall be subdivided into a subclause for definitions and a subclause for imported construct modifications if there are any modifications to the imported integrated resource construct for each kind. Each definition or modification shall be provided in a separate subclause.

EXAMPLE - Example format for application interpreted model clause:

5 Application interpreted model
5.1 Mapping table
5.2 AIM EXPRESS short listing
5.2.1 Fundamental concepts and assumptions
5.2.2 <title of AP> types
5.2.2.1 <title of AP> type definitions
5.2.2.1.1 <TYPE 1>
5.2.2.1.2 <TYPE 2>
5.2.2.1.n <TYPE n>
5.2.2.2 <title of AP> imported type modifications
5.2.2.2.1 <TYPE 1>
5.2.2.2.2 <TYPE 2>
5.2.2.2.n <TYPE n>
5.2.3 <title of AP> entities
5.2.3.1 <title of AP> entity definitions
5.2.3.1.1 <ENTITY 1>
5.2.3.1.2 <ENTITY 2>
5.2.3.1.n <ENTITY n>
5.2.3.2 <title of AP> imported entity modifications
5.2.3.2.1 <ENTITY 1>
5.2.3.2.2 <ENTITY 2>
5.2.3.2.n <ENTITY n>
5.2.4 <title of AP> rule definitions
5.2.4.1 <RULE 1>
5.2.4.2 <RULE 2>
5.2.4.n <RULE n>
5.2.5 <title of AP> function definitions
5.2.5.1 <FUNCTION 1>
5.2.5.2 <FUNCTION 2>
5.2.5.n <FUNCTION n>

Where only one item is included at a given level in the structure (such as only one rule being defined), no additional level of subclause is required.

Use the following required text and format (indented here to distinguish it from other text) as an introduction to the AIM EXPRESS short listing:

[ISO 10303 required]

5.2 AIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources (and the AICs) and contains the types, entity specializations, rules, and functions that are specific to this part of ISO 10303. This clause also specifies modifications to the text for constructs that are imported from the integrated resources (and the AICs). The definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes that are not imported into the AIM. Requirements stated in the integrated resources that refer to select list items and subtypes apply exclusively to those items that are imported into the AIM.
[end required]

If AICs are not used, the phrase "and the AICs" shall not appear in either of the first two sentences of the required wording.

The documentation for imported entity and type modifications shall follow the form used for entity and type definitions given in 6.5.7.

The following text shall follow the title of the subclause:

[ISO 10303 required]
The base definition of the <construct name> <entity or type> is given in ISO 10303-xxx. The following modifications apply to this part of ISO 10303.
[end required]

The following types of imported text modifications have been identified for documentation in this clause of the AP document:

— addition of application specific examples;

— clarification of the interpretation of the meaning of a particular construct;

— clarification of the interpretation of the meaning of one or more attributes of an imported entity;

— specification of additional informal propositions;

— specification of associated global rules.

The definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM.

The integrated resources contain entities that have a SUPERTYPE relationship to other entities in the integrated resource schema. When imported into the AIM, some of the subtypes of that entity may be eliminated in the using schema. Similarly the list of SELECT type may be pruned. When pruning occurs on super type and select type, this pruning shall be documented in the fundamental concepts and assumptions.

Application-specific examples may be defined by the AP developers to provide the implementor of the AP with a better idea of the meaning of a particular construct within the context of the AIM. The examples shall be documented in the same way as other examples.

An application protocol may require a generic definition from the integrated resources to be made more specific within the context of the AIM. The following text shall be used to introduce a general modification or addition to the definition of an imported construct:

[ISO 10303 required]
The definition of <construct name> is modified as follows:
[end required]

An application protocol may require the generic definition of an attribute or attributes of a particular entity to be made more specific within the context of the AIM. These shall be documented in a subclause for the imported entity modifications of the entity to which the attribute belongs. The following text shall be used to introduce a modification to attribute definitions:

[ISO 10303 required]
The attribute definitions are modified as follows:
[end required]

The above text shall follow the attribute definitions heading. The modified or extended attribute definitions shall then be documented in the same manner as defined in the layout style rules in clause 6.

Any additional informal propositions that are defined for imported entity types from the integrated resources shall be documented in a subclause for the imported entity modifications or the entity to which the proposition applies. The following text shall introduce the additional informal propositions:

[ISO 10303 required]
The following additional informal propositions apply:
[end required]

The above text shall follow the informal propositions heading. The informal propositions shall then be documented in the same manner as defined in the layout style rules in clause 6.5.7.1.

All global rules that are defined in the AIM which apply to imported entity types from the integrated resources shall be documented in the imported entity modifications subclause for each entity to which one or more rules applies. The heading "Associated global rules:" shall be used. The following text shall introduce the associated global rules:

[ISO 10303 required]
The following global rules defined in this part of ISO 10303 apply to the <entity name> entity:
[end required]

This will be followed by a list of global rule names, each of which is followed by a reference to the relevant subclause.

EXAMPLE - — rule_name_for_this_entity (See 5.2.4.n.)

After completion of the USE FROM statements, a note shall list the part of ISO 10303 where each schema identified in the USE FROM statement is documented. The note shall be of the following form:

[ISO 10303 required]

NOTE - The schemas referenced above can be found in the following parts of ISO 10303:

<schema_1> Clause <n> of this part of ISO 10303

<schema_2> ISO 10303-42

[end required]

The elements of the note are arranged in two left-justified columns, without punctuation.

8.7 Documentation of conformance requirements

This clause shall list the conformance requirements and the required level of completeness for conforming implementations of the AP. This clause may reference the abstract test suite for the AP.

Additional conformance requirements for specific types of implementation shall be referenced in this clause and fully explained in annex C of the AP being documented.

Use the following required text and format (indented here to distinguish it from other text) as an introduction:

[ISO 10303 required]

6 Conformance requirements

Conformance to this part of ISO 10303 includes satisfying the requirements stated in this part, the requirements of the implementation method(s) supported, and the relevant requirements of the normative references.

An implementation shall support at least one of the following implementation methods:

— <reference to one or more parts in implementation method series, e.g., ISO 10303-21>.

Requirements with respect to implementation methods-specific requirements are specified in annex C.

The Protocol Implementation Conformance Statement (PICS) proforma lists the options or the combinations of options that may be included in the implementation. The PICS proforma is provided in annex D.

[end required]

If the AP specifies more than one conformance class, the following text should be used:

[ISO 10303 required]
This part of ISO 10303 provides for a number of options that may be supported by an implementation. These options have been grouped into the following conformance classes: <Provide a brief description of the classes.> Support for a particular conformance class requires support of all the options specified in that class.

Conformance to a particular class requires that all AIM elements defined as part of that class be supported. Table <number> defines the classes to which each AIM element belongs.
[end required]

This text should be followed by a series of subclauses specifying the options within each conformance class and a conformance class table. For an example of a conformance class table see Table 6.

Table 6 - Conformance class elements

AIM element	class				
	1	2	3	4	5
AIM_element_1	X			X	
AIM_element_2		X	X		
AIM_element_3					X

If the AP specifies only one conformance class, the following text should be used:

[ISO 10303 required]
This part of ISO 10303 provides for only one option that may be supported by an implementation. This option shall be supported by a single class of conformance which consist of all the units of functionallity for this part of ISO 10303.
[end required]

A note shall identify the abstract test suite for the AP. For those abstract test suites that are not yet published a footnote shall be added to the note to indicate that the abstract test suite is to be published. The note shall be of the form:

[ISO 10303 required]

> NOTE - ISO 10303-<part number> defines the abstract test suite to be used in the assessment of conformance <include footnote if not yet IS>. ISO 10303-32 <include footnote if not yet IS> describes the conformance assessment process.

[end required]

8.8 Documentation of annexes

The required annexes of an AP are:

— A: AIM EXPRESS expanded listing (normative);

— B: AIM short names (normative);

— C: Implementation method specific requirements (normative);

— D: Protocol Implementation Conformance Statement (PICS) proforma (normative);

— E: Information object registration (normative);

— F: Application activity model (informative);

— G: Application reference model (informative);

— H: AIM EXPRESS-G (informative);

— J: Computer interpretable listing (informative);

Annexes with the following titles may be included if appropriate:

— K: Application protocol usage guide (informative);

— L: Technical discussions (informative);

The bibliography, if included, shall be an element of the standard that shall appear after the last annex:

— Bibliography.

Annexes shall be labelled in alphabetical order; however the letter "I" shall be omitted from the order. If any of the optional annexes are not included, adjust the labelling accordingly.

8.8.1 Normative annexes

8.8.1.1 AIM EXPRESS expanded listing (annex A)

The AIM EXPRESS expanded listing is derived from the AIM EXPRESS short listing (provided in 5.2 of the application protocol document), and is documented in annex A. The AIM EXPRESS expanded listing is the documentation of the expanded EXPRESS USE FROM statements and the AP unique EXPRESS declarations.

The EXPRESS expanded listing shall be preceded by the following text:

[ISO 10303 required]
The following EXPRESS is the expanded form of the short form schema given in 5.2. In the event of any discrepancy between the short form and this expanded listing, the expanded listing shall be used.
[end required]

The AIM EXPRESS listing is documented in accordance with the following rules:

— The layout and style rules for EXPRESS language statements given in clause 3 shall apply.

— The listing shall be separated from the main body of the annex by comment delimiters "*)" and "(*". Within the listing no other comment delimiters shall be included that separate the EXPRESS declarations from the main body of the prose. However, tail comments, i.e., comments beginning with --, shall be included.

— The following order of EXPRESS language declarations shall be followed: constant, type, entity, rule, function, and procedure.

8.8.1.2 AIM short names (annex B)

This annex shall contain a table of all the entities defined in annex A and their corresponding short names (see 6.6.1.1). The table shall be titled "AIM short names of entities". (See 6.6.1.1 for the format to be followed to prepare that table). Use the following text (indented here to distinguish it from other text) to introduce the table.

[ISO 10303 required]
Table B.1 provides the short names of entities specified in the AIM of this part of ISO 10303. Requirements on the use of the short names are found in the implementation methods included in ISO 10303.
[end required]

8.8.1.3 Implementation method-specific requirements (annex C)

This annex shall include any implementation method-specific requirements beyond those stated in clause 6. If there are no such requirements, include the following sentence:

[ISO 10303 required]
There are no implementation method-specific requirements for this part of ISO 10303.
[end required]

However, most APs will require that the header section of an exchange structure (ISO 10303-21) identify the AIM schema (only). In this case, include the following text:

[ISO 10303 required]
The implementation method defines what types of exchange behaviour are required with respect to this part of ISO 10303. Conformance to this part of ISO 10303 shall be realized in an exchange structure.

The file format shall be encoded according to the syntax and EXPRESS language mapping defined in ISO 10303-21 and in the AIM defined in annex A of this part of ISO 10303. The header of the exchange structure shall identify use of this part of ISO 10303 by the schema name '<schema_name>'.
[end required]

8.8.1.4 Protocol Implementation Conformance Statement (PICS) proforma (annex D)

The Protocol Implementation Conformance Statement (PICS) proforma shall be included as appendix D. The PICS proforma shall cover all options and conditional functions, elements of procedure, parameters, options, and other capabilities identified in the AP. The PICS proforma shall be in the form of a questionnaire to be completed by the supplier or implementor of an implementation of the relevant AP.

Use the following text and format for documenting PICS proforma:

[ISO 10303 required]
This clause lists the optional elements of this part of ISO 10303. An implementation may choose to support any combination of these optional elements. However, certain combinations of options are likely to be implemented together. These combinations are called conformance classes and are described in the subclauses of this annex.

This annex is in the form of a questionnaire. This questionnaire is intended to be filled out by the implementor and may be used in preparation for conformance testing by a testing laboratory. The completed PICS proforma is referred to as a PICS.
[end required]

8.8.1.5 Information object registration (annex E)

Each AP shall include an annex giving information object identifiers as defined in ISO/IEC 8824-1. See 4.3.2.4.3 for details and the normative reference necessary to support this annex. For document identification change the following:

sssss: the integer identifier for the ISO standard number. This identifier does not include the part number of the standard.

ppp: the integer identifier for the part number of the ISO standard.

v: the integer identifier for the version of the standard. The version number of the first edition of the standard shall be 1; subsequent modifications of the standard, whether by way of corrigenda, amendments or new editions shall have version numbers one larger than the previous versions.

> EXAMPLE 1 - { iso standard <sssss> part(<ppp>) version(<v>) } would be changed to { iso standard <10303> part(<514>) version(<1>) }.

> EXAMPLE 2 - The first edition of ISO 10303-224 has the version number 1. A technical corrigendum to the first edition results in a version number of 2.The second edition of ISO 10303-224 will have a version number of 3.

The version number shall be "1" for IS registration, "0" for DIS and FDIS registration, and "-1" for CD registration.

For schema identification change the following:

If the schema is unchanged from the schema in a previous version, its version number shall be unchanged. Otherwise, its version number shall be changed to reflect the new version number of the altered standard.

NOTE this may result in some version numbers being unused for some schemas.

object: the integer identifier of the type of information object in the standard. The value "1" identifies the object as a schema. At the time of publication of this document, no other values have been assigned. In the future, SC 4 may assign other values of this field to identify other information objects, such as entities, defined types, or conformance classes.

NOTE If further information object type identifiers are to be defined, consult with the Quality Committee for an object type number and follow a similar form as that used for schemas.

schema-name: name of the schema in which all occurrences of underscore (_) have been replaced by hyphen (-).

schema_name: name of the schema with underscore.

nn: an integer number that has been assigned to the schema. In the first version of a standard, these numbers shall be assigned sequentially to the schemas, from 1 to m. In subsequent versions of the standard, (whether through corrigenda, amendments or new editions) existing or modified schemas shall preserve this integer identifier. New schemas shall be assigned new values of the integer that have not been previously assigned. If schemas from previous versions of a standard are deleted from the standard, their values of this integer shall not be reassigned.

EXAMPLE Corrigenda 1 to standard part nn, results in schema S1 changing to version 2 but leaves schema S2 unchanged at version 1. In the new edition of the standard (version 3) both schema S1 and S2 are changed; both are now reported as version 3 of the schema, even though there has never been a version 2 of schema S2.

The version number shall be "1" for IS registration, "0" for DIS and FDIS registration, and "-1" for CD registration.
[ISO 10303 required]

Annex E
(normative)

Information object registration

E.1 Document identification

To provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard <sssss> part(<ppp>) version(<v>)}

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO <sssss>-1.

E.2 Schema identification

To provide for unambiguous identification of the schema specifications given in this application protocol <schema_name> in an open information system, object identifiers are assigned as follows:

{ iso standard <sssss> part(<ppp>) version(<v>) object(1) schema-name(<nn>) }

is assigned to the schema_name> expanded schema (see annex A).

The meaning of these values is defined in ISO/IEC 8824-1, and is described in ISO <sssss>-1.
[end required]

8.8.2 Required informative annexes

8.8.2.1 Application activity model (annex F)

The application activity model (AAM) shall be included as annex F. The AAM provides a representation of the activities that use product data in the application context. The AAM shall be represented in the IDEF0 activity modelling format, although other formats may be used.

Use the following text to introduce annex F:

[ISO 10303 required]
The application activity model (AAM) is provided as an aid to understanding the scope and information requirements defined in this application protocol. The model is presented as a set of figures that contain the activity diagrams and a set of definitions of the activities and their data. The application activity model is given in Figures F.<n> through F.<n>. Activities and data flows that are out of scope are marked with an asterisk.
[end required]

Examples of in-scope and out-of-scope elements that are used for clarification shall be included as notes.

8.8.2.1.1 Application activity model definitions

Use the following text to introduce the application activity model definitions subclause:

[ISO 10303 required]
The following terms are used in the application activity model. Terms marked with an asterisk are outside the scope of this application protocol.

The definitions given in this annex do not supersede the definitions given in the main body of the text.
[end required]

Definitions shall be documented following the rules for other definitions as given in 4.3.2.1. Asterisks, when required, shall be placed after the term and before the definition.

8.8.2.1.2 Application activity model diagrams

Use the following text to introduce the application activity model diagrams subclause:

[ISO 10303 required]
The application activity model diagrams are given in Figures F.1 through F.n. The graphical form of the application activity model is presented in the IDEF0 activity modelling format. Activities and data flows that are out of scope are marked with asterisks.
[end required]

If there are no activities or flows out of scope, the last sentence shall be omitted.

8.8.2.2 Application reference model (annex G)

The application reference model (ARM) shall be included as annex G.

Use the following text to introduce the application activity model:

[ISO 10303 required]
This annex provides the application reference model for this part of ISO 10303. The application reference model is a graphical representation of the structure and constraints of the application objects specified in clause 4. The graphical form of the application reference model is presented in <insert the proper name of the graphical form, IDEF1X or EXPRESS-G>. The application reference model is independent from any implementation method.
[end required]

Append the following sentence to the introduction text if the diagrams use the EXPRESS-G graphical notation:

[ISO 10303 required]
EXPRESS-G is defined in annex D of ISO 10303-11.
[end required]

Append the following sentence to the introduction text if the diagrams use the IDEF1X graphical notation:

[ISO 10303 required]
The diagrams use the IDEF1X graphical notation [n].
[end required]

Where [n] is the reference to the Bibliography for FIPS PUB 184

The ARM shall be presented in a formal information modelling language such as IDEF1X or EXPRESS-G (see 5.4).

Use the following form for the caption of each ARM diagram.

Figure <Y> - ARM diagram (<j> of <k>)

where <Y> is the figure number, and <j> indicates the page of total pages, <k>, that cover this schema.

8.8.2.3 AIM EXPRESS-G (annex H)

The AIM EXPRESS-G diagrams shall be included as annex H. Rules for formatting these diagrams are found in 5.4.

Use the following text to introduce the AIM EXPRESS-G diagrams:

[ISO 10303 required]
The diagrams in this annex correspond to the AIM EXPRESS expanded listing given in annex A. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.
[end required]

Use the following form for the caption of each figure containing an EXPRESS-G diagram.

Figure H-<n> - AIM EXPRESS-G diagram <subject area of diagram>

Where <n> is the diagram number.

8.8.2.4 Computer interpretable listings (annex D)

Annex D shall provide electronic access to the list of short names provided in annex A and the EXPRESS specified in this part. This access is provided through the specification of URLs that identify the location of these files on the Internet. The EXPRESS file shall correspond to the short form provided in the body of the standard, without any intervening prose. The listing shall not contain any comment delimiters of the kind "*)" and "(*" that separate the EXPRESS declarations from the main body of the prose. However, tail comments (those beginning with "--") may be included.

NOTE - The SC4 Secretariat will generate these files from the archive version prior to registration.

Use the following text (indented here to distinguish it from other text) and format for documenting this annex. In the URL for the EXPRESS, replace "nnn" in "partnnn" with the number of this part of ISO 10303 and "is" with the stage of the part. Confirm the URL with the SC4 Secretariat prior to publication.

[ISO 10303 required]
It also provides a listing of each EXPRESS schema specified in this part of ISO 10303 without comments or other explanatory text. These listings are available in computer-interpretable form and can be found at the following URLs:

Short names: http://www.mel.nist.gov/div826/subject/apde/snr/
EXPRESS: http://www.mel.nist.gov/step/parts/partnnn/is/

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

NOTE - The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

[end required]

8.8.2.5 Bibliography

A bibliography if provided shall be an element of the standard that shall appear after the last annex and shall be documented in accordance with 4.4.2. It shall contain as a minimum a reference to the IDEF0 activity modelling format and to the EXPRESS-G format used for annex G.

Use the following text to reference the IDEF0 standard:

[ISO 10303 required]
[<n>] *IDEF0 Federal Information Processing Standards Publication 183, Integration Definiton for Functional Modeling (IDEF0)*, FIPS PUB 183, National Institute of Standards and Technology, December 1993.
[end required]

8.8.3 Optional informative annexes

8.8.3.1 Application protocol usage guide

An AP usage guide may be provided as an annex. This annex documents AP usage guidelines and gives descriptions of how application integrated constructs should be used.

8.8.3.2 Technical discussions

Relevant technical discussions may be provided as an annex. If provided, they shall follow the format used to prepare the other annexes.

8.9 Documentation of index

In addition to the information outlined in 4.4.3, the index shall list the locations of each definition in clause 3 and the definitions of units of functionality. The name of the index entry shall appear at the left margin in lowercase and the page number shall appear at the right margin with
dot leaders.

For each application object defined in clause 4.2, the index shall list the locations of the application object definition, the application assertions the object participates in, the location of the application

object in the mapping table, and the location of the application object in the ARM diagrams. The application object index entries shall appear in the following manner:

application_object_name
  application assertion . . . . .
  application object . . . . .
  ARM diagrams . . . . .
  mapping table . . . .

Similarly, AIM elements may be described in multiple locations. For each AIM element, the index shall list the locations of the AIM short listing definition; should it exist; the location in the AIM expanded listing; the location of the AP specific AIM element where it appears in the AIM element column of the mapping table; and the location of the AIM element in the AIM diagrams. The AIM element index entries shall appear in the following manner:

AIM_element_name
  AIM diagrams . . . .
  AIM EXPRESS listing <plural_of_construct_type> . . . .
  AIM EXPRESS short listing <plural_of_construct_type> . . . .
  mapping table . . . .

When the AIM element is an entity, replace <plural_of_construct_type> with "entities". When the AIM element is a type, use "types". When the AIM element is a rule, use "rules". When it is a function, use the word "functions".

The index shall not include the uses of an application object or AIM element.

9 Documentation of the abstract test suite series of parts of ISO 10303

This clause gives preliminary rules and guidelines specific to documenting the abstract test suite (ATS) series of parts of ISO 10303. Each part of ISO 10303 that is a member of the abstract test suite series shall be documented separately. These documentation requirements supplement the requirements listed in clauses 4 and 5 of this standing document. Information on the procedures for developing an abstract test suite is provided in the *Guidelines for the development of abstract test suites*.

The elements of a part of ISO 10303 that is a member of the abstract test suite series of parts shall be documented in accordance with clause 4 of this standing document.

Further rules and guidelines for documentation of the abstract test suite series of parts of ISO 10303 are still under development. Until these rules and guidelines has been stablised, refer to the *Guidelines for the development of abstract test suites*, especially the annexes.

Annex A

(normative)

Title page

The title page shall be completed in full for all parts of ISO 10303. A sample title page follows this page. As of June 1, 1997, this version of the title page shall be used on all TC 184/SC4 documents.

An electronic version of the title page is located on SOLIS in the sc4/editing/cover directory. That directory also includes a readme file that gives instructions for completing the title page. Be sure to access the readme file before filling out the title page.

ISO TC184/SC4/WG_ N___

Date: yyyy-mm-dd

Supersedes ISO TC 184/SC4/WG__ N____

ISO/[ballot stage] [standard number]-[part number].[ballot cycle]
Standard title: Series title: Part title

ABSTRACT:

KEYWORDS:

COMMENTS TO READER:

This document has been reviewed and noted by the ISO TC 184/SC4 Quality Committee and SC4 Secretariat and has been determined to be ready for this ballot cycle

Project Leader:	**Project Editor:**
Address:	**Address:**
Telephone:	**Telephone:**
Telefacsimile:	**Telefacsimile:**
Electronic mail:	**Electronic mail:**

Annex B
(informative)

Example Issue Log

This Issue Log is an example of an optional log that may be kept by any part editor to track the status of outstanding issues. While not required, the keeping of an issue log for each part of ISO 10303 is recommended:

Issue Log
for the
Supplementary Directives (SC4 N537)
Last updated: 30 March 1997

ISSUE NUMBER: SEDS-342
AUTHOR: USA
CLAUSE: clause 9.
CLASSIFICATION: major, editorial
STATUS: Outstanding <If status is "Closed", supply the date.>
DESCRIPTION:
Abstract test suite developers must complete the set of rules for documenting abstract test suites before the Supplementary Directives can be considered as providing the complete set of guidelines for the format to be followed to prepare parts of ISO 10303.

PROPOSED SOLUTION:

RESOLUTION:

Annex C
(informative)

Criteria for lexical definitions

The following quote and recommended practices are from *A Concise Introduction to Logic* by Patrick J. Hurley:
"Because the function of a lexical definition is to report the way a word is actually used in a language, lexical definitions are the ones we most frequently encounter and are what most people mean when they speak of the 'definition' of a word. Accordingly, it is appropriate that we have a set of rules that we may use in constructing lexical definitions of our own and in evaluating the lexical definitions of others."

Rule l: A lexical definition should conform to the standards of proper grammar.
Rule 2: A lexical definition should convey the essential meaning of the word being defined.

The attributes mentioned in the definition should be the important or necessary features of the thing defined, not trivial ones.

Rule 3: A lexical definition should be neither too broad nor too narrow.

A definition is too broad if the definition applies to things other than the things that are being defined.

Rule 4: A lexical definition must not be circular.

A circular definition uses the definiendum in some way in the definition and is thus not genuinely informative.

Rule 5: A lexical definition should not be negative when it can be affirmative.
Rule 6: A lexical definition should not be expressed in figurative, obscure, vague, or ambiguous language.

A definition is figurative if it involves metaphors or tends to paint a picture instead of exposing the essential meaning of a term. Example: "Architecture" means frozen music. A definition is obscure if its meaning is hidden. One source of obscurity is overly technical language. A definition is vague if its meaning is blurred. A definition is ambiguous if it lends itself to more than one distinct interpretation.

Rule 7: A lexical definition should avoid affective terminology.

Affective terminology is any kind of word usage that plays upon the emotions of the reader or listener.

Rule 8: A lexical definition should indicate the context to which the definition pertains.

This rule applies to any definition in which the context of the definition if important to the meaning of the definiendum. Whenever the definiendum is a word that means different things in different context is, a reference to the context is important.

Annex D
(informative)

Checklist

D.1 Project Leader check list

After the project team's Quality Committee representative submits a dated and signed internal review report to the Project Leader, the Project Leader shall review the part documentation and verify the items marked on the checklist below to be correct. After the Project Leader has determined the internal review report has satisfied the reporting criteria and has completed this checklist, he or she shall date and sign this document, and send email containing the date of the sign-off, the part number and title, and the n-numbers of the approved part and any related documents to the sign-off exploder (sign-off@cme.nist.gov). The Project Leader shall send the part, a copy of this completed checklist, and the internal review report to the Working Group Convener for approval.

A current checklist can be found at the following URLs:

<http://www.nist.gov/sc4/www/necsdocs.htm>

D.2 Convener check list

The Working Group Convener shall review and verify to be correct the items identified in the list below by placing a check mark in the box of the items verified and signing and dating the checklist after completing verification. The Convener shall then send an Email message to the SC4 sign-off exploder (sign-off@cme.nist.gov) stating the date of the sign-off, the SC4 standard number, part number and title, and the n-numbers of the approved part and any related documents. The part is now ready for release to the SC4 Secretariat for ballot preparation. The part (electronic and paper formats as required by the Secretariat), the completed checklists, and all other supporting documents (electronic formats only) for the part shall be sent the SC4 Secretariat.

A current checklist can be found at the following URLs:

<http://www.nist.gov/sc4/www/necsdocs.htm>

Bibliography

[1] STRUNK, Jr., W. & WHITE, E.B.; *The Elements of Style*; Macmillan Publishing Co, 1979.

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